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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Secretary: E. J. Griffiths, 20, Fisher Street, Swansea.

Forthcoming Events.

OCTOBER 14.

Institute of Metals (North-East Coast Local Section):—Address by the Chairman, Mr. C. Gresty.

OCTOBER 16.

Steel Structural Research:—Conference at the Institution of Civil Engineers in London.

Institution of Welding Engineers:—Ordinary meeting in London. "The Replacement of Castings by Weldings," Paper by P. L. Roberts.

Institute of British Foundrymen.

OCTOBER 11.

Lancashire Branch (Burnley Section):—Opening meeting at the Technical College, Burnley. "Belgian Moulding Sands in the Iron Foundry," Paper by F. Griffiths.

OCTOBER 16.

London Branch:—Ordinary meeting in London, Paper by J. L. Francis.

Superfluous Cast Iron.

One has only to compare the average metal thickness of many types of castings made in this country with similar castings made abroad to realise that great economies can be effected by a general thinning of the metal line of British castings. We in this country still adhere to the Victorian "virtue in weight" belief and are slow to wake up to the fact that our Continental competitors have long since dropped this shibboleth. There is, of course, a limit to the extent to which a casting can be lightened from both the standpoints of strength and successful manufacture. The question of strength is, for the many types of castings to which this comment particularly alludes, and which are so obvious as not to require enumeration, of very little importance, meaning no more than the safe capacity for handling and transit. The question of manufacture may in very crude foundries favour a maximal rather than a minimal mass, although this type of foundry must eventually found lightly or founder heavily.

What is the position of the British public as far as heavy domestic castings are concerned? They, the British public, have already been educated to light utility articles, for in every town in England to-day can be found the cheap and apparently successful kind of stores (ironmongery in the English sense is hardly the name) where dumped foreign goods predominate.

A massive, heavy article, comprising one or more castings, for instance, has no more value when in efficient commission than has a similar sound article of 25 per cent. less weight. One can hardly believe that the buyer will be so far-sighted as to think of the eventual value of the article as scrap. The heavy casting is not demanded by the buying public; it is rather thrust upon them.

The saving of iron when a casting is made no heavier than its use and making demand is only one of the factors which make for reduction of cost. There is also the cost of the melting, the easier handling, and, last but not least, the cheaper freight. It is safe to state that the small founders of this country could in many cases save, without detracting from the value of their products, many thousands of pounds. The larger founders can also in many cases look with advantage to the heaviness of their products with a view to cutting out unnecessary weight.

Where it is found necessary to make castings heavy in order to minimise foundry loss or ease machining, it is advisable to study the behaviour of the melting plant. A little better practice in the cupola control to produce really hot metal is much cheaper than unnecessarily heavy castings. Further, attention to the chemical analysis and probably to the refractory value of the moulding or facing sand should accompany a weight-saving campaign. The proposition, of course, varies with the different types of castings.

It can be appreciated that mass ceases to have value when it exceeds the safe requirements demanded by the making and using of any particular article. In other words, it is sheer waste. Our Continental and American competitors have long realised these facts, not only in castings but in almost every engineering commodity. It is undoubtedly one of the factors which tell in world competition.

Competition.

The foundry industry has offered many instances recently of the interplay of competitive forces—both from without and from within. Thus cast iron has, under certain conditions, to meet the competition offered by cast steel and the non-ferrous metals. We have recently had the case of cast iron *versus* welded structures. At one time there was a certain amount of replacement of special cast-iron parts by stainless steel, on account of surface finish and corrosion resistance. Chromium plating, however, has given ordinary cast iron in this respect a new lease of life. So the age-old and interminable process goes on, and nobody will deny its beneficial effect to everybody concerned. It keeps us perpetually on our toes lest our particular material be supplanted. The nitrogen hardening of cast iron is an answer to the possibilities of nitrogen-hardened steel.

The founding industry offers other illustrations, too, for cast iron to a limited extent has to meet the competition of malleable iron, sand cast of permanent-mould cast, ordinary against centrifugal cast, and so on. Here, as with cast iron *versus* steel, the rivalry is not between one industry and another, but between one part of the industry and another. We cannot save coke or refractories without materially affecting two industries whose primary job is to try and make us buy more coke and more refractories. Sometimes, in meeting competition of a rival material the founder has to give something which offers less chance of further work in the form of replacements and spare parts or repeat orders. But in this, as in other matters, for the industry as a whole the long view is better than the short one, and a maker who creates a prejudice in the mind of the buyer does not merely injure himself, he injures the whole industry of which he is part. He injures the status of the material in general.

The important point to remember is that no founder to-day can view without alarm the supplanting of cast iron by any other material. We are no longer in the happy position of making everything in cast iron and of being able to smile at the loss of a little business here and a little there. For the detached foundries especially, a loss of this kind is likely to show itself in an annual loss of tonnage instead of a gain. What we all want to see is not a loss, but an increase. It is, therefore, up to us, not merely to answer one advance elsewhere by another, but to take the aggressive and win back some of our lost tonnage.

XUM

The Slump in Base Metals.

By "Onlooker."

As if gathering momentum the lower they go, the non-ferrous group has lately set up a fresh record for this year, while copper and zinc have fallen lower than previously recorded this century. It is an astounding state of affairs, and at the time of writing it looks very much as if the bottom has not yet been reached in spite of the fact that quotations may steady for a time and even improve somewhat. This is especially true of tin, in which a reduction in visible supplies was reported at the end of September, but great uncertainty exists regarding the carrying on of the output restriction scheme, which, if stocks in England are going to be brought down to a reasonable level, ought to be pursued relentlessly for some months to come.

Among the broad influences at work compelling this downward swoop of metal values must be mentioned over-production, abnormally heavy stocks and a greatly restricted demand, while the immediate cause of new low levels being established is the failure of the long-awaited autumn trade to show itself in America. There has, of course, been a decided absence of "push" in metal salesmanship of late, for sellers have had no confidence in counselling their customers to buy at a time when practically every day has brought a fresh decline. This, of course, means that a reserve of buying power is being built up, which, when unleashed, will turn markets into a turmoil until the demand is satisfied. Herein lies the greatest danger of the situation, for in copper, at any rate, where the unsatisfactory quota system of the Exporters' Association is in force, it is going to be extremely difficult for users to secure all the metal they require on any particular day.

Curtailment of copper production has been effected on a fairly considerable scale in the United States, but it has not been sufficient to counterbalance the falling-off in demand, and in other fields of copper-mining enterprise output has so far been maintained. Dividend announcements by copper companies are now beginning to lay bare the fact that profits have been considerably encroached upon by the price level ruling during the first half of 1930, and it may be taken for granted that the last six months of the year will be considerably worse. As a matter of fact, many properties are now working at a loss, while others can show only a bare margin of profit, a state of affairs which must eventually compel a scaling down of production and a rise in the price.

Spelter, about which a good deal of optimism was voiced some weeks ago when the Zinc Cartel was reported to be re-establishing itself, has fallen below £15, and is within a little of the lowest price ever recorded for the metal. Production is still on a fairly generous scale, stocks both in Europe and America heavy, and demand extremely poor, with but little prospect of any improvement unless the use of brass is going to be increased through a lower price. Trading in the spelter ring on the Metal Exchange has been very restricted for a long time now, but so poor is the outlook that even moderate offers have been sufficient to depress the market in no uncertain manner. In common with copper and tin, spelter is now below its pre-war price.

Up to a short time ago high hopes were entertained that lead would withstand the all-round weakness shown by other metals, but at the moment values have fallen below £17, and the tendency is none too strong. Statistically the position is not so adverse as with other metals, but the failure of Germany to take anything like her normal quota of lead has exercised a bad effect and compelled from time to time accumulations of lead in this country. Selling pressure on the London market has been valiantly combated by the "group," but it has not been possible entirely to resist the downward thrust of adverse circumstances.

British Business Men to Visit Roumania.

At the express desire of His Majesty the King of Roumania, Industrial Newspapers, Limited (The Foundry Trade Journal), is inviting a chosen number of leading industrialists to pay a visit to Roumania. The decision has been made to limit the invitations to those who are in representative and responsible positions and can speak with authority concerning that branch of trade or industry in which they are engaged. The purpose of the visit is to prepare the way, if the investigation prove the possibility, for the fuller and swifter development of trade between the two countries.

From crossing the Roumanian frontier the whole expenses, both business and social, during the stay of the delegation will be provided by the Union of Roumanian Chambers of Commerce and of the Union of the Chambers of Agriculture under the direct control of the Roumanian Minister of Commerce and Transport, M. Manoilesco, who, at the request of His Majesty, will supervise the arrangements. The King himself will receive the delegates.

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The winter draws near and travelling conditions in Roumania are not so good when November sets in. It is desirable that the delegation leave this month, so that it may enjoy the full amenities of travel.

Briefly, the proposal is that the delegation shall travel by special train, *via* Calais and the Orient Express, to the Roumanian frontier, and from this point the delegates will become the guests of the Roumanian authorities until they again cross the frontier on the return journey. Every detail of the itinerary is being planned with care and forethought. The whole absence from England should not be more than two full weeks. But those two weeks may, perhaps, mean much in the increase of future trade.

Comprehensive arrangements are being made to enable members of the delegation to get full information, industry by industry, and to see everything they may wish with a view to forming judgments on possible contracts.

The cost to each member of the delegation is limited to the travelling and incidental expenses from London to the Roumanian frontier and back.

The personal representative of the Minister of Commerce and Transport for Roumania is about to leave for England to provide the necessary visas and explain the itinerary and programme in Roumania.

St. Dunstan's.

". . . An help meet for him" is the title of the 15th annual report issued by the Executive Council of St. Dunstan's. The financial position of the organisation is based solely upon voluntary contributions and has been well maintained. If the existing public support continues for a further fifteen years, the report states that at the end of that period the position of the organisation would be such as to render unnecessary further financial aid. Not only could it conduct its various beneficial services to the blinded soldiers, but also guarantee that in their old age they would be adequately provided for. Such financial security is eminently desirable, and we would ask those of our friends in the foundry industry who have supported St. Dunstan's in the past not to withhold their aid from the work of this excellent institution.

Random Shots.

No one could describe the past week as dull. First, there were the German election results. We had the remarkable phenomenon of a joint report by the General Council of the Trades Union Congress and the Federation of British Industries—the first occasion on which the two bodies have ever tacitly admitted a common interest in anything. Appropriately enough, their report was addressed to the Government. The meeting of the Imperial Conference is a most momentous occasion, which may well prove a milestone in Empire development. Finally, we had the meeting of business men which, under the leadership of Sir William Morris, formed a National Council of Industry.

* * *

To comment on all these events would be impossible in a short space. The success of Hitler in Germany is a blow to democratic government and parliamentary procedure, and many columns have been written explaining its significance or its insignificance, according to what view you take of the matter. Some people seem to have convictions and others merely prejudices, and world movements can readily be explained to suit the latter if you are prepared to go the required lengths of self-deception.

* * *

Those who read the accounts of the crusade opened by Sir William Morris will have seen the usual statement of the necessity for economy, Empire trade, reduction of taxation, reduction of unemployment, that has been said so often in the past few years by Government commissions, manufacturers' associations, chambers of commerce and so on, and will doubt whether a new body is really likely to do much more than has already been done.

* * *

To continue my comments of last week on American topics, arising from an interview I had with a friend who had recently been there, I naturally inquired about Prohibition, and he assured me that only in non-prohibition countries like England was it impossible at certain times to get alcohol. In the States you can certainly get it at any time you want it. On the other hand, if you don't want it, you are scarcely likely to have it, so to speak, thrust down your throat. Thus you come back believing that Prohibition is an enormous success or a total failure, according as you fall into one or the other of these categories. He said that public sentiment is definitely changing, and that some sort of modification may be expected inside five years. The only people who are now really opposed to the repeal of the Volstead Act appear to be the bootleggers.

* * *

Motoring in the cities is practically reduced to a procession going at whatever speed is permitted by the elaborate system of signals and lights usually installed. Many of these are so arranged that they bring traffic on one track to a standstill even if nothing is proceeding at right angles on the green light. Furthermore, filtration is not allowed in many cases, so that a car desiring to turn left has to do a quarter-turn on the green light and wait again until the green shows.

* * *

Few English firms seem to do business there, and those who do do not appear to advertise very little either in the States or Canada. Yet English standards of taste, dress and deportment are universally accepted as the best. When the shops desire specially to recommend an article they ticket it "imported" or even "English made." Differences in modes of travel, in climatic conditions and a crystallisation of national sentiment produce articles—clothing, for instance—totally different from those commonly made and worn in this country.

Marksman.

The Influence of Moisture due to Leaking Tuyeres on Blast-Furnace Conduct.

By C. D. Abell.*

The moisture in the blast varies, and is greater in summer than in winter on an average. The average "winter" moisture was found to be 0.40 lb. per cub. ft., and the "summer" moisture was 0.60 lb. per cub. ft.—though occasionally very much more. It is the only source of moisture which continually dilutes the reactions of the blast furnace; extraneous entry of water from the jumbos, tuyeres, etc., is to be condemned as most dangerous and unsatisfactory, though very often difficult of repair—the results of a long-continued dispersal of moisture in the hearth being disastrous to the normal working of the furnace.

Moisture causes the formation of the iron and manganese spinel oxides, *i.e.*, FeO. Fe_2O_3 and MnO. Mn_2O_3 instead of the normal spinels (hercynite).

$H_2O + C \rightarrow CO + H_2$ endotherune (1)

$Fe + H_2O \rightarrow FeO + H_2$ exotherune (2)

Actually what happens is best represented by

$2H_2O + 3FeO + CO \rightarrow FeO.\ Fe_2O_3 + CO_2 + 2H_2$ (3)

similarly :—

$2H_2O + 3MnO + CO \rightarrow MnO.\ Mn_2O_3 + CO_2 + 2H_2$ (4)

That is to say, 36 lbs. of moisture are sufficient to abstract 216 lbs. of FeO. Fe_2O_3, or 213 lbs. of MnO. Mn_2O_3 by reason of the reactions stated above (provided normal equilibrium were attained, which of course is not realised in practice, the time factor allowing of only superficial or live contact reactions to take place).

If the wind blown contains 1 lb. moisture per 1,000 cub. ft. of air and the actual average volume blown is 5,000 cub. ft. per min., *i.e.*, 5 lbs. H_2O enters the furnace per min. Then obviously there is approximately 31 lbs. FeO. Fe_2O_3 (or 24 lbs. Fe, or 13.95 lbs. FeO) formed per min. (assuming for the moment a final equilibrium). Now, if the make is estimated at an average figure (as for the cold-blast furnace under consideration) at 50 lbs. of iron per min., there is a loss of approximately 50 per cent. in the slag. Thus 0.50 lb. of water per 1,000 cub. ft. on the same basis gives a 25 per cent. loss. If the iron slag ratio is 1 to 1½ approximately, this means a concentration in the slag of upwards of 16 per cent. FeO. Fe_2O. (7.2 per cent. FeO).

This is always supposing that equilibrium is obtained, but actually in normal practice this is not practicable, and only a small proportion reacts, but if the moisture figures rise too high it is easily seen how disastrous the reactions can become, since it tends to give fusible scouring silicates, especially of iron (manganese forms silicates, though not so readily), viz. :—

$x\ SiO_2 + FeO.\ Fe_2O_3 \rightarrow FeO.\ x\ SiO_2 + Fe_2O_3$

with the consequent occurrence in the hearth of pieces of apparently unreduced ore which consists in the main of Fe_2O_3, and this also accounts for the "slushy" or pasty character of the iron cast when the furnace is running irregularly due to the presence of Fe_3O_4 in the iron. The direct results of excessive moisture is a regular-working, low-temperature iron, with excess of sulphur and oxide, combined with poor fuel economy, and, of course, an increase in the rate of driving of the furnace, but with a smaller production. A factor of prime importance in this respect is the greater rate of combustion of hydrogen from the hydrogen—carbon-monoxide mixture of the upper zones, with its attendant disorganisation of the carbon-monoxide dissociation reactions upon which the furnace depends for regularly economic working. It deprives the burden of a most important stage of the process, namely, the solution of the primary carbon in the iron-sponge.

Assuming FeO in the slag to be 0.90 per cent. and the production of metal 50 lbs. of iron per min. measured in the hearth and 65 lbs. of slag per min., and the average moisture in the blast 0.5 lb. of water per 1,000 cub. ft., 5,000 cub. ft. of wind being blown per min., then 0.50 lb. of water is equivalent to 16 lbs. of iron per min. loss in the slag if normal equilibrium were established. But only 0.90 per cent. loss of iron oxide is found (equivalent to 0.63 per cent. of iron or 0.410 lb. per min.). Hence $\frac{0.41 \times 100}{16}$ = 2.5 per cent. of the total amount of loss possible, which shows how low the moisture must be kept for safety. One lb. of water on this basis would give 5 per cent. of the total; 2 lbs. of water would give 10 per cent., which, with the higher percentages of FeO actually obtained under such conditions of excessive moisture show how rapidly relatively small changes in the moisture produced very appreciably losses of iron. The extent of the possible reactions is always a function of the rate of driving, and the only remedy is to introduce more fuel and extra blast if danger is suspected from a leaking member, otherwise an indefinite period of stoppage can be possible before the trouble is located and repaired, apart from the after-effects on the working of the furnace.

Water is one of the greatest dangers of normal regular practice; up to 0.50 lb. per 1,000 cub. ft. the author (contrary to most authorities) believes it is beneficial in most cases by producing a certain amount of oxide in the iron, but above this figure it becomes a source of trouble, being, as well, a factor not always easy to discover, especially if it be intermittent in its action.

* Chief chemist to the Low Moor Iron Company, Limited, Low Moor, Yorkshire.

Pig-Iron Output of Holland.

The report of the Konin. Nederlandsche Hoogovens en Staalfabrieken, N.V., of Ymuiden, which has now been issued for the year ended with June 30, 1930, states that the third blast furnace was completed during the year, and the operation of the second furnace was discontinued in July. Excepting some interruption in working, No. 1 and No. 2 furnaces were in full blast during the year. The former produced 114,697 tons of pig-iron and the latter 145,484 tons, and out of the total output of 260,181 tons (256,479 tons in 1928-29), the quantity sold in Holland amounted to 54,809 tons as compared with 57,622 tons in the previous year. The production of coke totalled 250,123 tons in 1929-30 as against 255,150 tons in the preceding year.

The report states that the financial results were only affected to a small extent by the prevailing depression, but since the end of the financial year the situation has become much more unfavourable, and the results for the new year are bound to suffer from them. So far, however, the company has been able to keep up the production without adding to the stocks to any large extent; the selling prices of pig-iron, however, have considerably declined.

Including the undivided profits from 1928-29, the net profits for the past year amount to 441,856 fl. as compared with 484,617 fl. A dividend at the rate of 4 per cent. is proposed on the preference capital, and the balance of 416,856 fl. has been carried forward. (Current exchange rate 12.04 florins to the £.)

Belts saturated with oil should be cleaned by first washing them with motor spirit or naphtha, then sprinkling powdered chalk or Fuller's earth on the inner face of the belt while running just before stopping. After a few hours, scrape off the powdered chalk with an old file and again wash with motor spirit.

Some Factors affecting Foundry Prosperity.

At Manchester, on October 4, Mr. R. W. Stubbs, in his presidential address to the Lancashire Branch of the Institute of British Foundrymen, chose for his theme "The Conditions of Industry." He said that British manufacturers found that the greater number of competitors had reduced their markets, and their costs were unduly increased by heavy taxation, the higher standard of living, and the burden of war-time liabilities. So far as rationalisation had been carried, it could not be said to have been conducive to a reduction of production costs. Moreover, there was a real danger of building up trusts and monopolies disadvantageous to workpeople and consumers, and to the country as a whole.

Coal was the bedrock of all production costs, affecting directly and largely light, power and heat. It had a very important bearing on transport charges, which in this country exceeded those paid by foreign competitors and were a serious burden on the cost of the finished article. It might be that by greater mechanisation and in other ways improvements in the mining industry would reduce the price to the industrial and domestic consumer. That would have a far-reaching effect and give immediate relief. But the greatest need of industry at the present time was a lightening of taxation; at the least there ought to be a definite assurance by the Government that the burden would not be increased. Then the movement towards reorganisation and reconstruction must be co-ordinated and carefully planned for the good of the community as a whole. It was not a question of bolstering-up one industry; it was a question of saving the country, and all concerned should co-operate with full acknowledgment of their respective obligations and responsibilities—industry, commerce, finance, labour and the Government. The task should not be entered upon in detail until the whole position had been examined by the best brains in the country without bias.

(A full report of Mr. Stubbs' address will appear in our next issue.)

Catalogues Received.

Sand-Blast Apparatus.—Messrs. J. W. Jackman & Company, Limited, of Vulcan Works, Blackfriars Road, Manchester, have sent us an advance copy of a 4-page leaflet which describes and illustrates two cleaning cabinets, one worked on the suction system and the other on the pressure system, and a rotary-table machine. The fourth page is devoted to a portable apparatus. The message is clearly set out in a businesslike and attractive style.

High-Temperature Electric Furnaces.—The Wild-Barfield Electric Furnaces Company, Limited, Elecfurn Works, North Road, Holloway, London, N.7, have sent us an advance copy of a new catalogue (Section K) which deals with their furnaces capable of achieving and closely maintaining temperatures up to 1,400 deg. C. This allows the heat-treatment of high-speed steel to be undertaken. The resistance is effected by passing current through bars of recrystallised carborundum, whilst continuously accurate control is effected by a device which equalises heating conditions otherwise impaired by oxidation of the resistors. The catalogue contains 12 clearly illustrated pages, and well maintains the high standard of publicity which this company has set for itself.

Centring drills should be ground to an angle of 100 deg., as against 118 deg. for an ordinary drill. If this is done, the edges of the main drill will reach the sides of the hole before the point touches the bottom and will start without wobbling.

Cobalt Magnet Steels.

At a meeting of the Sheffield Metallurgical Association, held recently, Mr. H. E. Kershaw read a Paper on "Cobalt Magnet Steels," in the course of which he pointed out that steels with a cobalt content of from 3 per cent. up to 36 per cent. have been made containing varying amounts of chromium, tungsten, molybdenum and carbon. The first cobalt steels were straight steels containing only iron, cobalt and carbon as their chief constituents. These steels required hardening in water or brine. Their magnetic efficiency was not good and they presented serious hardening difficulties.

After an enormous amount of experimentation by a number of firms, continued the author, the manufacture of cobalt magnet steels is now divided into two classes: the low and medium cobalt-chrome steels and the high-cobalt steels. Taking the cobalt-chrome variety, these are subdivided into one containing 9 per cent. of cobalt, and one containing 16 per cent., but both containing 9 to 10 per cent. of chromium, 1.5 per cent. of molybdenum and 1.0 to 1.15 per cent. carbon.

These steels are air-hardening, but in order to obtain the best magnetic results it is not sufficient merely to heat the steel up to the hardening temperature and allow it to cool in air. Such a treatment will harden the steel and will give fairly good magnetic results, but considerable improvement can be brought about by giving the steel a triple heat treatment. It consists of first of all heating the magnets fairly quickly up to 1,150 to 1,200 deg. C. (1,250 deg. C. for larger sections), holding at this temperature for 2 or 3 mins., and then cooling in air. The steel is then in the austenitic condition and is almost completely non-magnetic. The second part of the treatment is to reheat to about 720 deg. C. At about 680 deg. C. a marked recalescence occurs, and the temperature of the magnets rises spontaneously. This recalescence is, of course, due to the breakdown of the austenite in the steel, which now becomes magnetic. After this has died away, cool the magnets in air again. Now reheat to about 1,000 deg. C. for the final hardening. The heating up should be done fairly quickly, and as soon as the magnets are soaked through at the temperature, withdraw them from the furnace and cool in air.

Taking next the high-cobalt steels. These require a considerably higher percentage of cobalt for a given magnetic output than steels of the cobalt-chromium type. The cobalt content is usually 36 per cent. along with about 6 per cent. of chromium and 4 to 6 per cent. of tungsten and 0.9 per cent. of carbon. These steels are of the oil-hardening types. A single treatment only is necessary, but accurate temperature control is essential, as any elevation above the necessary hardening temperature, which is usually about 950 deg. C., brings about the retention of austenite on quenching, and a low remanence is obtained. The rate of cooling is important. It is very necessary that thin oil should be used, and that it should be kept cool. This alloy has better magnetic properties than any other known at the moment, and B—H max values of 900,000 to 1,000,000 are regularly obtained; the figure usually increases inversely as the section, and in the case of thin sections it is possible at times to produce values up to 1,200,000.

A message from Melbourne states that the Australian General Electric Company, Limited, Messrs. Ferguson, Pailin, Limited, and the Metropolitan-Vickers (Australian) Proprietary, Limited, have combined for manufacturing purposes, each retaining its identity in regard to brands and having its separate sales organisation. The new company has been incorporated under the title of the Australian Electrical Manufacturing Company, Limited, and will have a capital of £800,000.

Drilling High-Manganese Steel.

Within the past few years, states "The Iron Age," new tool steels, new tool designs and new heat treatments have been perfected. All of these factors, carefully balanced, have produced tools which now successfully cut high-manganese steels and open new fields for their application. One of the latest developments is the "Hercules Major" drill, from cobalt high-speed steel of unusual analysis.

In order to drill high-manganese steel successfully a sturdy, well-proportioned tool is essential, and the drilling machine must have a positive feed and a speed mechanism powerful enough to drive the drill through. Tremendous pressure is exerted on the tool when cutting. The work must be held securely; if a radial drilling machine is used, the work should be placed to assure maximum rigidity of the machine. If possible, warm the drill point before using, this being good practice to follow for any high-speed-steel drill. Some users heat up the manganese steel itself to about 200 to 260 deg. C.; while helpful, this is not absolutely necessary.

The peripheral speed of the drill should be between 12 ft. and 15 ft. per min. The feed should be between 0.003 and 0.010 in. per revolution. A 1-in. drill, for example, gives good service with a feed of 0.006 in. and a speed of 50 r.p.m. Coolant or lubricant should not be used. The drill should not be permitted to idle or rub when starting a cut, nor after the cut has been started. For best results a hole should be drilled through in one continuous cut. Intermittent cutting, such as produced when a drill is used in a ratchet brace, is not recommended. On the "break through," manganese steel has a tendency to "spin," which is detrimental to the drill. A heavy feed during this period will increase the life of the drill.

Deep-Hole Drilling.

Deep-hole drilling offers difficulties and materially shortens the life of the tool, due to the excessive heat generated. For example, in drilling a 3½-in. deep hole with a $\frac{15}{16}$-in. drill, some users obtain best results by drilling down 2½ in. in one continuous cut and then drilling five or six other holes to the same depth. By the time six holes have been drilled, the metal around the first hole is cool enough to permit the drill to start a new cut and drill 1 in. deeper without heating to the breakdown point. On deep cuts, some users cool the drill point in oil between holes. The practice of starting a new cut in a drilled hole or cooling the drill in oil are exceptions to the general recommendations made above, but in the cases mentioned they have proved practical.

It is economical for the operator to note the condition of the cutting edges and corners as drilling proceeds. If the corners are dull for $\frac{1}{16}$ in. to $\frac{1}{8}$ in. back, it is advisable to remove the drill and regrind it, although the tool apparently is cutting satisfactorily. By so doing the maximum number of holes per drill will be obtained, rather than a few more holes per grind.

Certain makes of drills, as received from the factory, are pointed to meet the severest conditions and give the best service. The point angle is 68 deg., the cone angle is 120 deg. and the lip clearance is 6 deg. to 8 deg. To reduce the rake angle and give a stronger cutting edge, a flat section is ground on the lips. This grinding operation also thins the web down to about $\frac{1}{8}$ the diameter of the drill.

Swedish Embargo on Exports of Scrap Iron.—The British representative at Stockholm reports that the period during which the export of malleable scrap iron (except galvanised or tinned scrap) from Sweden is prohibited, except under licence, has been extended until February 28, 1931.

Company Meetings.

A. Reyrolle & Company, Limited.—At an extraordinary general meeting of Messrs. A. Reyrolle & Company, Limited, electrical engineers, Hebburn-on-Tyne, a resolution was unanimously carried to increase the capital of the company from £500,000 to £700,000 by the creation of 200,000 new shares of £1 each, to be issued at such time and on such terms and conditions as the directors think fit. Mr. Norbert Merz, who presided, in proposing the resolution, referred to the great developments of workshops and plants, the forming of the new Bushing Company and the amalgamation with Messrs. J. H. Holmes & Company, Limited, Newcastle. Those developments had more than absorbed all their capital resources, and since 1928, when the last issue of shares was made, the company had expended approximately £340,000 on capital account. The works were extremely busy.

Staveley Coal & Iron Company, Limited.—The annual meeting of the Staveley Coal & Iron Company, Limited, was held recently in Sheffield. Sir William Bird (chairman), who presided, said they were all aware that the coal industry, throughout the year, had been and still was in a depressed condition. On August 1 last the new Coal Mines Bill became law, and district schemes had now to be submitted to, and approved by, the Board of Trade, not later than October 31. Personally, he thought it was a great misfortune that the Government should interfere in the coal or any other trade. Conditions had been difficult enough for business during the last few years, and Government interference only made matters worse. Referring to the electricity department, which, he said, had done well, the chairman remarked that additional supplies had been given to the Bolsover and Chesterfield Councils for new pumping plants. They were now finishing building a new pipe line for Eckington and Mosborough. They had to resort to current income for capital purposes, as the board hesitated to ask for further capital in these days. The necessary capital for all industrial enterprises could only be met out of savings of the people, and the Government gave no encouragement nowadays to people to be prudent and save money. The only way that prosperity could be brought about in this or any other country was by extending trade to the utmost, and this was only possible provided that capital was found for the purpose.

Thos. W. Ward, Limited.—The annual meeting of Messrs. Thos. W. Ward, Limited, was held on September 30 at Sheffield. Mr. Joseph Ward (chairman), in moving the adoption of the report and balance-sheet, said they commenced the financial year with reasonable prospects of a good year, but, unfortunately, in April tonnages and values began to reduce, and quickly there began a fall in prices of scrap material, from which the market had not yet recovered. The serious fall in scrap prices, and the provision they had made in writing down values of stocks, had had a marked effect upon the figures shown in the balance-sheet, in reduced values, increased stocks and diminished turnover. In view of these exceptional circumstances, and the unsatisfactory condition of the coal, iron and steel trades generally, the directors felt they could congratulate the shareholders on the results achieved. The experiment they had made of running the Low Moor Forge plant for the manufacture of Low Moor best Yorkshire iron and other brands had been rewarded with success. Given ordinarily good trade, they felt that the future results would justify their policy at Low Moor. Shipbreaking operations, which represented 38 vessels amounting to 112,913 gross tons, suffered most severely through foreign competition and through the fall in the prices of scrap material. The question of the scrapping of obsolete British merchant ships, for which a Government committee of inquiry had recently been appointed, was one to which considerable attention had already been given. He thought the suggested policy of scrapping vessels over 25 years old was a good one. It was essential that British ships should be dismantled in British shipbreaking yards, and in order to do this it would no doubt be necessary, at periods when foreign competition for these ships was keen, for some subsidy to be made to the British owners of obsolete tonnage for the loss they would at times incur by dismantling in this country. The chairman urged that some recognition of the actual normal value of scrap as compared with pig-iron should be shown by the user. The unprecedented fluctuations that had taken place were not a good thing for those engaged in steel manufacture.

Scottish Views on Foundry Rationalisation.

STRUCTURE OF THE INDUSTRY.

The opening meeting of the 1930-31 session of the Scottish Branch of the Institute of British Foundrymen was held in the Royal Technical College, Glasgow, on October 4. Mr. H. W. Winterton, the retiring President, occupied the chair.

The Late Mr. James Ellis.

The CHAIRMAN, in welcoming members at the opening of another session, said that he was pleased to see so large an attendance. He was, however, sorry that his first duty was a somewhat painful one. Most of them would probably have learned of the death of Mr. J. Ellis, and he wished to pay tribute to Mr. Ellis not only as a Past-President of the Institute of British Foundrymen and as an enthusiastic foundryman, but also as a colleague in the firm over whose destinies he (the speaker) had the honour to preside. He had known Mr. James Ellis for over thirty years as one of the keenest of the Institute members, who was always ready to assist others, and in particular the juniors. His efforts on behalf of the foundrymen and the foundry industry were recognised at the recent Middlesbrough Conference, when he was presented with the Oliver Stubbs medal as a mark of the esteem in which he was held by his colleagues. He was one of the founders of the Institute, and by his death they had lost a link with the older school of foundrymen. It was a pleasure to the Scottish members to remember that the last Paper which Mr. Ellis presented to the Institute was given at a meeting of the Scottish Branch last year.

The members then stood in silence for a minute.

The CHAIRMAN proceeded that his next duty was rather more cheery, viz., to welcome back a former President of the Branch after a very serious and prolonged illness. They were all delighted to see Mr. Tom Bell with them again and congratulated him upon his improved health, which they hoped would be maintained.

The SECRETARY having read the minutes and the meeting having approved them,

The CHAIRMAN said that he had now come to the concluding act of his presidency of the Branch; he had thoroughly enjoyed his year of office, which he thought had not been altogether unprogressive. He wished to thank all the members of Council and officers for their very loyal support and assistance during the year. He trusted that they all felt with him that at the end of the session their Branch was a little better than at the beginning. He had now to introduce his successor to the chair. Mr. Miller was well known to them all; he had done much useful work as a member of Council, and now received his reward in being selected to fill the highest office in the Branch. He bespoke for Mr. Miller the same generous and loyal support as they had given to him, and hoped that at the end of his term of office he would think as he himself thought, that occupying the chair was thoroughly worth while.

PRESIDENTIAL ADDRESS.

MR. J. MILLER then took the chair and said that before proceeding to deliver an address he felt that he could not do otherwise than thank the Past-President for his very kind remarks and good wishes for himself and also on behalf of all the members to thank Mr. Winterton for his efforts on behalf of the Branch during the past year. He had been an indefatigable worker, and having demitted office and left one chair he hoped that there would always be a chair for him to fill. Mr. Miller then delivered his presidential address, in the course of which he said:—

Rationalisation.

Mr. Winterton and Gentlemen,—In casting about for a suitable subject for a presidential address I have, like many others similarly placed, found it difficult to fix on one that has not been dealt with already. You will bear with me, then, if I treat the matter on the lines of thought that have been passing through my mind lately.

To-day the all-engrossing subject in industry is that of rationalisation. This big word, with such far-reaching results, has been described in plainer and more familiar terms as "combination," and that, as you are aware, is simply a joining-up of forces and the pooling of results. One of the main features of rationalisation is the introduction of machinery and still more machinery. Now history has proved to us that the introduction of machinery, inevitably in the first instance and for a time, produces unemployment, but it is an indisputable fact that this reacts later in greater production and to some extent on employment. It is between the two points that the danger zone lies from the workers' point of view. Concurrently with all that there lies in rationalisation, there is the total, or almost total, elimination of the personal touch or feeling for the producer from the machine so created—created as it is, at all costs, to reduce overhead charges and make profits, as well as increase production. There is also brought in its train the closing-down of the unprofitable units from the first grouping, and this will ultimately lead to a scrapping of such as time goes on, with the inevitable further throwing-out of workers from employment.

Speaking at a meeting in Paris at the Eighth-hour Convention in the month of May last, Miss Bondfield, the Labour Minister, said: "Referring to rationalisation, it was quite clear that this brought the workers face to face with an entirely new set of problems. World standards in labour conditions were increasingly improved with the technical progress of industry. They recognised the inevitability of rationalisation if the word meant bringing industry up to a standard of higher efficiency, but the workers must be given their share of the results." Quite recently a well-known captain of industry in the North of England resigned from the chairmanship and directorate of a well-known commodity because he foresaw in his combination the lack of soul and consideration for the need of others in this particular scheme of things and all of which are out with his vision of life as in his opinion it ought to be lived. His ideas and convictions are germane to what Miss Bondfield was darkly hinting at and contending for.

Further, the following excerpt is taken from the "Saturday Evening Post," an American weekly. Therein Mr. Ford, the world-wide-known motor manufacturer, says: "We can increase prosperity only as we increase production. If we increase the number of men employed without also increasing the production, we have not increased employment at all; we have only diluted it, for we must divide the amount available for wages in any company by the number of men, and if production drops per man, the wages of the men will, of course, drop. Any plant which comprehends doing work in less than the best way and in less time will only in the end decrease the number of men employed at wages high enough to make them consumers."

Again, Prof. T. E. Gregory, in his address at the recent British Association meeting, said, among other things: "The occupied population in the future is likely to be less industrialised than in the immediate past, and the growth of trades and occupation outside the narrow concept of industry will continue as rationalisation proceeds. The so-called staple industries will, as a result, probably employ a far smaller percentage of the population than was formerly the case, while the so-called luxury trades will employ far more."

It must be obvious also that it will, under the greater spread of rationalisation, become increasingly difficult for a man or men to run a small shop—I mean a country or small jobbing shop—because big combinations will naturally seek to keep their large and expensive plants going at all costs and reach and search out in all directions for work, and it is in this class of shop that the best tradesmen have been raised and developed.

Let us consider for a little how far we have been treading the field of rationalisation and how far, consciously or unconsciously, we have been helping on this most important and revolutionising movement. I would ask you to picture in your mind's eye an aspect from the family tree, having as its root and stem the efficiently-trained all-round moulder. Branching off on the right hand we have the apprentice moulder, the core-maker and the apprentice core-maker. On the left hand we have the shop labourer, and from that branch the very much miscalled semi-skilled man. Examining more closely each of these in turn, let us see if we can determine how far rationalisation, or the present-day modified form of it, has reacted on each of these in turn. First, the trained moulder and sand-craftsman. Does he stand where he did? In the heavy shops it may be agreed that he does, because so far no machine has been evolved for, say, loam work, though the same cannot be said for the job bedded in the floor, as in many instances the sand slinger has recently been successfully brought to bear on this side of the trade. Taking the light or medium shops, it is undoubtedly the case that machines have encroached very distinctly in his direct field of operation, and whereas he formerly was the determining factor in the production of any casting made, he has now, in consequence of the latter-day methods, to take a more or less back seat. It is quite true that his skill is still drawn upon for the finishing or closing of larger and more intricate castings, but the key position he formerly held is his no longer, because, where he had to determine himself the best method of moulding a job, *i.e.*, gating, hangering, etc., and where his skill was evinced in negotiating his own partings and drawbacks, machine plant has been so planned out as to eliminate all difficult or dangerous points to an almost plain ram and draw, with, in most cases, boxes planned to suit the particular job. Added to this there is the greater use of oil-sand cores for work on machines from what may relatively be called blank patterns, by the aid of which the draw-backs and under-cutting are avoided that previously made a difficult job and required the skill of the trained moulder to circumvent.

Where our skilled tradesman is employed on machine moulding, he has now become, by force of circumstances, an expert swabber, patcher and sleeker, and from the very nature of his work day by day in its similarity he is very apt to lose, more or less according to the stamp of man he is, his keen thorough interest in his work, and his line is now apt to be, to use a stock phrase, "Come night, come ninepence."

The core-maker, brother-in-arms to the moulder, has suffered also, but not quite to the same extent. The advent of the oil-sand core in all classes of shops has reduced his status somewhat, in that there is less geometrical work done on the core bed, straight rods and bent wire doing away with much of the old grating work, etc. The very nature of the material used precludes much ramming at all, and as it comes to him prepared in a like manner day by day, the need for the old personal touch and feeling has gone also, and his hard-earned knowledge and skill are thereby much discounten-

anced. Indeed, so much is it so with this material, that boys and young lads are easily trained to do quite large jobs by the use of oil sand, apart altogether from small cores. The apprentice moulder and core-maker complete the picture on the right-hand side, but also, unhappily, form a very incomplete one. There, one might say, a national problem lies. Here in Glasgow and district they have proved to be an almost insuperable difficulty. Granted that some shops do obtain good material to work on, I venture to say that the bulk of experience is all the other way. The main trouble they suffer from may be described in two words as "absolute indifference." How far this has been occasioned by rationalistic tendencies in shops I cannot say, but that the boys in any shop have not their eyes about them few will deny, and that they have their ears open stands to reason, so that shop methods and how they hear their elders discuss them may have some bearing on their attitude. The subject could form many Papers in its varied aspects, but before leaving it I would express my own personal opinion that we do not get the right class of boy, and that, as growing lads, their bodies are fatigued to such an extent by their day's work and mis-spent evenings that to suggest evening classes for self-improvement and expect them to be taken up is asking more than can reasonably be expected. Add to this the aftermath of the war in parental defiance and the thirst for cheap amusement, so easily obtained nowadays, and I think you have pretty well got the gist of the problem. It is gratifying to know, however, that the Institute of British Foundrymen is going very closely into the solution of this problem, and that the Scottish Branch is taking an active part therein.

The first branch on the left-hand side of the tree is the foundry labourer, the steady plodder who digs the holes in the floor and fills them up again, who knows where all the box plant is and the most suitable box for a job, who helps to load the stove carriage and does the hundred-and-one odd jobs in the foundry. So far he has not been rationalised nor will he readily be, but remains the same rational being we have all known him to be. From him the best semi-skilled man branches off into the plate-moulder, who rams, parts, finishes, closes and pours his own work and is a self-contained unit. In this class of work there is, as you are aware, little coring work. This system has been brought to a fine art, as witness the result in the Falkirk district, which has been copied all over England.

I now propose merely to outline the further branching off of the family tree, and that as we proceed speed increases, and, for the most part, direct skill diminishes.

From the plate-moulder, the basis of machine moulding, the next step was to save the hand-drawing of pattern, and so we get the machine to draw down and strip, or box lifted up, but hand rammed. That being an accomplished fact, we must needs now do away with the hand ramming, and so the power squeezer or combined squeezer and jar machine is evolved. Core work is, or may be, considerable in the method depending on the nature of the casting to be produced.

Success having been developed along these lines, larger jobs must be catered for, and so arrives the medium and large-size jarring machine, but here again a step forward is made, and we now have a combined machine in the jar turn-over pattern-draw machine, in which man-handling is reduced to a minimum, and to the capacity of such machines it would seem that the size of the job is the only limit.

In all of these, block patterns and oil-sand cores have played a very large part in production and ease in manipulation. Yet again, with the moulding plant so efficient, the next step forward is in continuous pouring, applicable, of course, to a rather limited number of shops, but still in being here as well as America and the Continent.

To meet all the demands of these elaborate machines and methods, we come finally, if one is not too greatly daring in saying so, to the costly sand handling and preparing plants which are a progressive feature of some shops.

Now, if I have made a good case, in how far does the practical moulder participate in it all? I am afraid the answer is "Very little." Looking back over some 30 years' practical experience of machine moulding and coming into contact with the progressive evolutions of the machines produced up to the latest sand slinger, I personally am convinced that had the Moulders' Unions held a wider and more sympathetic view at the inception of machines instead of cold-shouldering the innovation, the present situation would, at least in degree if not in the main, have been different, and it may be that the future will put the practical moulder back into his own again.

Vote of Thanks.

Mr. N. McManus, Vice-President, said that they had listened to a unique and interesting address; it was rather out of the usual, but yet thoroughly practical. He thought that Mr. Miller had given them a true picture of what is taking place in the foundry industry to-day. He proposed that they accord their thanks to the President for his address.

Mr. Tom Bell, Past-President, said that he had much pleasure in seconding the vote of thanks. They had listened to a most interesting Paper which had touched on the practical side of foundry work. He thought that Mr. Miller had dealt with matters which he believed moulders never thought about. Regarding Mr. Miller's last paragraph about the practical man coming back to his own, he hoped to live to see it. In the early days of machines the moulders did not receive them in the manner that they should have done.

The President said he thanked them all for the manner in which they had listened to his address and for the vote of thanks. As he had stated at the beginning, he had a difficulty in finding a subject, but if he had interested them or helped them a little then he was well repaid.

Mr. Norman C. Blythe then read a Paper for which he was awarded the Surtees Gold Medal.

At the conclusion of the meeting members adjourned to the Cadora Restaurant, where, in the company of lady friends, a social function was held.

Mr. John Cameron, Past-President of the Institute, proposed a vote of thanks to the President for presiding and congratulated him upon the happy manner in which the new session had been inaugurated.

The President briefly returned thanks.

Analyses for Ingot Moulds.

Writing in the Bulletin of the French Foundry Technical Association, Mr. A. Bettinger suggests the following chemical analyses for various types of steelworks ingot moulds:—

Type of ingot mould.	Si.	Mn.	S.	P.
3 to 5 tons.	2.0 to 2.2	0.5	<0.06	<0.10
6 to 8 tons.	1.8 to 2.0	0.6	<0.06	<0.10
8 to 12 tons.	1.6 to 1.8	0.8	<0.06	<0.10
Carrying feeding heads or arranged for bottom pouring, 6 to 8 tons.	1.7 to 1.9	0.7	<0.06	<0.10

When grinding aluminium, or aluminium alloys, the coolant used must be free from grit, chips, etc. A muslin filter should be placed over the outlet pipe so that the coolant is filtered as it leaves the machine and flows into the tank.

French Foundry Technical Association.

The Ninth Foundry Congress, organised by the French Foundry Technical Association, will be held this year on October 24 and 25 at the National School of Arts and Crafts, 151, Boulevard de l'Hôpital, Paris. Foundry technicians desiring to attend this function should, in the first place, communicate with the Secretary of the Association, at 20, Rue Richer, Paris, who will send them full particulars before the opening of the Congress. The programme of the Congress is given below.

October 24.

9 a.m. to 10 a.m. Registration of participants.

First Session.—10 a.m. Opening of the Congress. Address by Mr. A. Damour, President of the French Foundry Technical Association.

Speech by Mr. E. Labbé, Inspector-General for Technical Education.

The following Papers will be read and discussed:—

"Potential Avenues of Progress for Jobbing Foundries," by Mr. Léon Thomas, Honorary President of the French Foundry Technical Association.

"Importance of Auxiliary Services in the Malleable Iron Foundry," by Mr. Maurice Staub, Ing. A. et M., foundry manager.

12.30 p.m. Luncheon.

Second Session.—3 p.m. Presentation and discussion of the following Papers:—

"Nickel-Vanadium Cast Irons," by Mr. Jean Challansonnet, metallurgical engineer C.A.M.

"Some Scientific Principles underlying the Casting of Metals," by Mr. H. C. Dews, Vice-President of the London Section of the Institute of British Foundrymen.

"Developments in Superheating and the Production of Steel Castings," by Mr. D. C. Zuege, of the Sivyer Steel Casting Company, Milwaukee. (Exchange Paper of the American Foundrymen's Association.)

Report of the Sub-Committee on "Methods of Testing Cast Irons," presented by its President.

October 25.

Third Session.—9.30 a.m. The following Papers will be presented and discussed:—

"Malleable Iron: Its Conditions of Manufacture and Inspection," by Mr. Marcel Rémy, foundry owner, at Herstal, Belgium.

This session will be devoted entirely to malleable cast iron, and the discussions will be made following those of the Pan-European Congress at Liége on the same subject. Malleable-iron founders and those interested are specially invited to attend.

12.30 p.m. Luncheon.

Fourth Session.—3 p.m. Discussion of the following Papers:—

"Relation between the Mechanical Properties of Test-Bars which characterise a High-Tensile Brass Propeller and those of the Metal from which it is made," by Mr. A. de Leiris, engineer, Génie Maritime, Indret Dockyard.

"Note on the Standardisation of Copper Alloys," by Mr. G. Devaux, President of the Non-ferrous Division, and Mr. Régnier, manager of the Seguin Etablissements.

"Report of the Sub-Committee on Awards," presented by Mr. Léon Thomas.

Distribution of prizes to winners of the foundry competitions.

Address by Mr. A. Damour, President of the Association.

7.30 p.m. Closing Banquet, followed by dancing, at the Hôtel Lutetia, 43, Boulevard Raspail, Paris, under the presidency of Mr. E. Labbé, Inspector-General for Technical Education. Tickets 85 francs. Evening dress optional.

Foundry Educational Developments.

TYNESIDE ACTIVITIES.

The first meeting of the 1930-31 session of the Newcastle and District Branch of the Institute of British Foundrymen was held at the Neville Hall, Newcastle-upon-Tyne, on September 27, when Mr. A. Logan delivered his presidential address.

Before commencing his address, Mr. Logan took the opportunity of welcoming Mr. F. Sanderson back after his serious illness. He also drew the members' attention to the announcement on the circular, concerning classes for foundry apprentices, which stated that the Branch had been instrumental in getting the Rutherford College to commence special classes for foundry apprentices, commencing that month. Practical work was to be a distinctive feature of these classes, and a small foundry was being specially equipped for the purpose. The Branch Council hoped that members would encourage apprentices to enrol, as they would receive a course of instruction especially adapted to the foundry trade. It was hoped to run a four-year course, which would include every section of foundry work.

PRESIDENTIAL ADDRESS.

Mr. Logan, in the course of his presidential address, said:—

Mr. Smith and gentlemen,—I have no desire to inflict upon you anything in the nature of a formal address, but I would take this opportunity of drawing attention to one or two subjects which I consider of interest to this Branch at the present time.

Let me state first of all that I consider it a high honour to occupy the position I do at this present moment. It is an honour which I regard not so much a personal one as an outward and visible indication of the co-operation which exists between foundry practice and metallurgy. No one has greater opportunity than the President of assessing the value and importance of the part played by the Secretary. The President is in office for a year only, but the Secretary is the one permanent official on whose guidance the President and Council depend. It is largely upon the soundness of the Secretary's policy, his energy and activity that the success of a branch is built. It is a very great loss, therefore, that, owing to the very severe illness which Mr. Sanderson has recently undergone, and, acting under medical advice, he is reluctantly obliged to relinquish the more active part of the secretarial work.

On behalf of the Branch I would like to pay tribute to all that Mr. Sanderson has so ungrudgingly done for us. There is a tremendous amount of work involved in the secretaryship of a Branch like this—a lot of it is unseen and uninspiring and requires a good deal of enthusiasm to carry through conscientiously. Mr. Sanderson has always put the interests of the Branch before other things and worked hard and enthusiastically for its success. May I extend to him our sympathies and best wishes, together with the hope that he may long be spared to a life of usefulness and activity.

There is another matter which affects the future of the Branch, that is, the appointment at the last annual meeting in June of a Past-President, Mr. Victor Stobie, to be Junior Vice-President of the Institute. We regard this appointment with pleasure and pride, and congratulate Mr. Stobie on the honour. In the normal course of events this means that the Annual Convention will be held in Newcastle in June, 1932, and that this Branch will be responsible for the whole of the organisation, entertaining and raising of the necessary funds.

It will be remembered that this Branch set a new standard when the Convention was held here in 1924—a standard which, we believe, has never been exceeded—so that we shall have our resources strained to maintain our last effort, and we must try if possible to surpass it. However, this is merely by way of preliminary announcement.

Members of a local branch of an Institute, such as we are here, are sometimes apt to concentrate their whole attention on the doings and activities of the local Branch only, forgetting that the local branch is but a unit—part of the whole. The more enthusiastic make an effort to attend the Annual Convention and follow the business of the Institute in person. The programme of the Annual Convention, as you know, usually occupies three days. The morning of the first day is occupied with an official welcome, followed by the annual business meeting of the Institute, election of officers, etc. Then comes the presidential address, and the time that remains is devoted to hearing and discussing Papers. The whole of the second morning is given over to the reading and discussing of Papers. The modern tendency is to crowd in as many Papers of as great variety as possible, the usual number being about 9 or 10. The morning sessions usually last three hours, so that the total time available for the speeches of welcome, business meeting, presidential address and reading and discussion of ten Papers is only six hours. If it is recollected that at an ordinary Branch meeting 2 to 2½ hours is taken up with the reading and discussion of *one* Paper, it will be seen that the time available is very inadequate, and that some items are merely skimmed over—in fact, are taken as read. Such is usually the case with the Annual Report of the General Council; and, without criticising or attempting to suggest how matters might be improved, I would submit that it is a pity that the only knowledge the ordinary member has of the activities and policy of the Institute as a whole, is the meagre information which is issued in the form of the Annual Report. As I have said, the Annual Report is usually taken as read, but as every member receives a copy by post from the General Secretary, all members, whether they attend the Annual Conference or or not, have an equal chance to keep up to date with the doings of the Institute as a whole—that is, as far as published information allows. It is quite possible, therefore, unless the Annual Report is very *carefully* read, to overlook matters of quite vital importance. It is possible, for instance, that members have overlooked the significance of the paragraph in the Annual Report entitled "Educational Activities." Those who were at the Annual Conference and heard the presidential address would probably be very surprised to hear the President refer to the establishment of "Craft" or "Foundry" Certificates.

Educational Activities.

For years we have had Papers and discussions on foundry apprenticeship and training schemes, yet in a flash, so it seemed, something concrete had been evolved. Actually, of course, the General Council have been tackling this question for the last two years; but the ordinary member may well be excused if he has failed to realise up to the present that something of a revolutionary nature has now been introduced to the foundry world. In my opinion, the introduction of a "Technical Certificate" is of such importance and is likely to have such far-reaching effects that it demands our full attention.

The paragraph dealing with this matter in the annual report is headed "Educational Activities," and it might be as well to read it in case you have overlooked it, or missed its significance.

In the last annual report it was stated that satisfactory progress had been made towards the establishment of national certificates in foundry practice; substantial further progress has since been made. The Institution of Mechanical Engineers, in conjunction with the Board of Education, has agreed to initiate a modification of the Institution's National Certificate suitable for students of foundry practice. This certificate will be signed by the President of the Institution of Mechanical Engineers and endorsed by the President of the Institute of British Foundrymen, and it is expected that it will be a national diploma of high technical standard which will be recognised as a high-grade professional qualification in foundry practice.

Many of the technical colleges who prepare students for the Institute of Mechanical Engineers' National Certificates are now in a position to arrange courses suitable for the modified foundry certificate when the demands arise in their respective areas. Members are urged to use their influence with students of foundry practice to take full advantage of these facilities.

Considerable progress has also been made towards the arrangement of a craft certificate in foundry practice of a national character. This certificate is intended for students who are taking courses of a less technical and more practical nature than those who prepare for the national certificate previously described, and it is hoped to arrange for the issuing of these certificates under the auspices of the City and Guilds of London Institute, which is a national examining body of the highest standard and of considerable experience.

An Advisory Committee has been formed to assist in the drafting of syllabuses and other arrangements, and the Institute is represented on this Advisory Committee by members of its Education Committee. Various national educational bodies who will be concerned with the preparation of students and the arrangement of classes are also represented.

The General Council is convinced that these steps will result in the near future in the consolidation and extension of training in foundry practice.

This, you see, refers to the establishment of two classes of certificate. In my opinion, this matter is of such importance to everyone that it was essential to have full details, so I wrote to the general secretary for further particulars. I am indebted to Mr. Makemson for kindly supplying the following information, which I think is sufficiently interesting to be given *verbatim*.

National Certificates—Present Position.

As a result of the questionnaire sent to the various Branches, it was decided to introduce two forms of certificates in foundry practice on a national basis:—(1) A technical certificate of professional standing; and (2) a craft certificate covering the requirements of the workmen or foremen.

After careful consideration it was felt desirable to work these certificates in conjunction with existing examining bodies, as it was felt that the numbers would be too small and the expense too great for the Institute to undertake the examinations alone. Negotiations were entered into, with the result that the Insitution of Mechanical Engineers has agreed to be responsible for the technical certificate.

The Institution at present issues a National Certificate in Mechanical Engineering, and it will now issue a similar national certificate embodying some of the previous subjects of the present one, but with the substitution of metallurgy and foundry practice in place of such subjects as heat engines and hydraulics. This certificate will be signed by the Presidents of the

Institution of Mechanical Engineers and the Institute of British Foundrymen.

The Institution of Mechanical Engineers has circularised all the colleges which prepare students for their present national certificate, and has informed them of the new certificate. These colleges who desire to prepare candidates for this new certificate are asked to form a new syllabus, which, when approved by the I.MechE., will be adopted, and they will then be in a position to prepare and submit candidates for the examination.

It may be a year or two before this scheme gets under way, but the machinery is practically in existence at present.

Craft Certificate.—This is the type of certificate which was most in mind on embarking on the Institute's scheme, and the City and Guilds of London Institute have promised to introduce the required examinations into their programme. Following the City and Guilds practice, an Advisory Committee has been formed to advise and govern syllabuses and the conducting of the examinations.

The progress made seemed to be so astonishing that I wrote again asking if the two certificates as outlined had been finally approved by the General Council and when they would come into operation. The reply received was as follows:—

In reply to your letter of September 4, both certificates have been agreed to by the General Council.

The professional certificate—that is, the one arranged by the Mechanical Engineers—can come into operation at once, or, at any rate, just as soon as the various colleges have their special course of instruction ready. These colleges will follow the same procedure as they do with the Mechanical Engineers' ordinary national certificate, that is, prepare a course of instruction and have it approved by the I.Mech.E. Some of the colleges are doing this, and will doubtless be in a position to offer courses of instruction next winter.

The craft certificate will not be ready to come into operation until the following winter, as the procedure varies from the other certificate in that there is a standard syllabus for the whole country, and the standard syllabus is at present in course of preparation.

Reverting to the professional certificate, the various college authorities will largely be guided by the demand for courses, and if they are pressed locally to get on with the job, it will expedite matters considerably. One Branch of the Institute has already approached its local technical college, and urged on the authorities the necessity of catering for the new course, and has offered to co-operate or assist in the preparation and administration of the courses if necessary.

Well, that is the position as it exists at the present moment with regard to the two types of certificate mentioned in the annual report. I have gone into this matter at some length, as I think that all should have a full knowledge of the schemes. I hesitate to pass any comment upon them, beyond the obvious statement that such schemes are bound to be beset with difficulties, especially at the start, and that it is too early yet to foresee what the effect will be in the future.

The questionnaire mentioned was duly received and considered by this Branch Council, who were not fully in agreement with the form it took. Their considered opinion at the time was that some scheme of educational training for foundry apprentices was required first, which would raise generally the standard of the youth in the foundry, and thus pave the way to some such certificate schemes at a later date.

This Branch has made a number of attempts from time to time to influence the local educational authorities to provide suitable classes for foundry apprentices, but without success. Following the reply to the questionnaire, however, another attempt was made, and the conditions being more favourable and largely through the efforts of Mr. Gresty, success was at last attained.

A committee consisting of representatives of this Branch of the I.B.F. and representatives of local firms met the Principal of Rutherford College. After deciding that it was very desirable to run special classes, and facilities being promised by the education authorities, it was left to a sub-committee to draw up a suitable syllabus. This syllabus was finally approved, and is embodied in the curriculum, which, no doubt, most of you have already seen by now.

Mr. Gresty undertook to deliver a propaganda lecture to inaugurate these classes a fortnight ago. The lecture was very successful, and I am glad to state that enrolling is taking place very satisfactorily. These classes are more or less experimental. It will depend largely, therefore, on the response during the first year or so as to whether they will be a success and will be carried on. It is up to us to do all we can to persuade all foundry apprentices to attend them and reap the benefit.

These classes were instituted independently of the certificate scheme of the General Council; in fact, the Committee had no knowledge at the time of the development made in the General Council's scheme. Therefore, when the national certificate schemes come fully into operation, as they apparently will within the next year, these classes may need to be slightly modified to bring them into line and enable the student to take eventually the national examination. If any such modification is necessary, however, it may be taken for granted that it will be carried out, and that these classes will then form the basis of training for the National Craft Certificate.

It is to be hoped that these classes, together with the introduction of National Craft Certificates, will have the effect of focussing attention upon the opportunities which are undoubtedly opening out for the trained foundryman. It is inevitable if these schemes go forward, that the foundry foreman and foundry manager of the future will have to possess a theoretical as well as practical training, proof of which will possibly be the possession of an appropriate certificate.

It is also to be hoped that the introduction of foundry classes will serve to direct the attention of the foundry apprentices taking them, to the advantages to be obtained by joining the Junior Section of the Institute, and eventually of becoming members.

Junior Section.

One would like to report in this connection that the Junior Section attached to this Branch is in a sound and flourishing condition. Unfortunately, this is not the case.

It is a fact to be proud of that this Branch led the way and formed the first Junior Section seven years ago. Since then Junior Sections have been formed at Lancashire, Birmingham, London and Glasgow. Our own Junior Section flourished and made useful progress for a number of years, but has gradually declined during the last two sessions, and is now struggling for its very existence. This is a very regrettable state of affairs, and may be news to many members.

It will be a great pity if, for want of a little encouragement, a little exertion on our part, we let this section flicker out. The Branch Council have had an appeal for assistance brought before them, and will give every consideration to the matter, but more can be done by the individual members themselves. Every member can help by using his influence to persuade the apprentices and juniors in his own foundry to join and regularly attend the meetings. May I appeal to all who have any influence in this direction to use it? A very interesting programme has been arranged for the coming session, and the hon. secretary, Mr. Charlton, will be glad to furnish further particulars or follow up possible members.

The introduction of classes and craft certificates is bound to have far-reaching effects, which will ultimately be all to the good. There is no doubt that one result will be a raising of the status of the foundryman. This will naturally follow as a result of the attraction of a better type of boy to the foundry. This implies no reflection on the present type of foundry apprentice and foundryman, but there will be no reason why the foundry should not attract the very highest possible type of boy. Indeed, it is imperative for the future welfare of the industries of this country, and the foundry industry in particular, that it should have available the very best brains and skill.

Recent Foundry Progress.

On every hand we see signs of the progress which is being made in foundry affairs. It must be a constant source of surprise, for instance, to those who were familiar with the conditions prevailing in the majority of British foundries immediately prior to the war, to see the progress which has been made within, say, the last ten years. A host of new ideas, new machines, tools, appliances, melting processes, etc., are constantly being evolved. New metallurgical principles are being applied in practice. It is, therefore, becoming increasingly difficult to keep up to date and abreast of modern progress. This is where one of the greatest functions of the I.B.F. becomes apparent. By attending the meetings and taking advantage of the works visits, we can keep in touch with what is taking place in our own district, whilst we have the opportunity at the various annual conventions of visiting works in other areas. We are thus able to enlarge our experience and pick up new ideas. It is not necessarily to be inferred that complete ideas are "cribbed" on these occasions, but rather that the sight of familiar jobs being carried out by unfamiliar methods or the use of new materials or operations, sets a train of thought moving which throws a new light on our own problems. The very fact of seeing something different keeps our perception and resourcefulness active. I suggest it is a very good investment, from the employers' point of view, to pay the expenses and encourage their more responsible men to attend these works visits, for undoubtedly the firms will ultimately benefit.

To speak of the benefits of membership to those who are already members is, of course, a case of preaching to the converted, but even the converted can fall from grace, so to speak, so that it is just as well to occasionally remind ourselves of the advantages we enjoy.

The prolonged slump in shipbuilding and engineering is bound to have the effect of making the payment of annual subscriptions difficult, and it is not very surprising, therefore, to find that the membership of this Branch is showing a tendency to decrease. This tendency can easily be checked if we are keen and enthusiastic. We have a very interesting session's programme in front of us, and all that remains to make the session a success is the full attendance of members.

May I conclude, therefore, with the personal appeal to all members actively to support the Branch during the coming session in every possible way by securing new members if possible, and particularly by your presence at the various meetings.

Vote of Thanks.

Mr. C. Gresty, in proposing a vote of thanks, said that he had enjoyed Mr. Logan's address. Being on an educational subject, it had come at a very appropriate time, when they had just launched the foundry classes. It was very true what he had said about the long time it took to get these classes established. It had taken twelve months. Practical work was also included in these classes. It had been a struggle, but by the help of various friends, particularly on the equipment side of the industry, they had been able to equip a small foundry at very little cost.

(*Concluded on page* 254.)

Foundry Hoist Blocks.

The advantages of electric lifting gear in foundries have been largely discounted by the high capital cost of suitable equipment, particularly when provided with creeping gear to give a definitely steady and very slow lifting speed.

The Transporting Machinery & Engineering Company, Limited, of 76, Victoria Street, London, S.W.1, include in their range of electric hoist blocks the micro-block, which is possessed of the double advantages of a slow lifting speed of 1 ft. per min. with a normal lifting speed

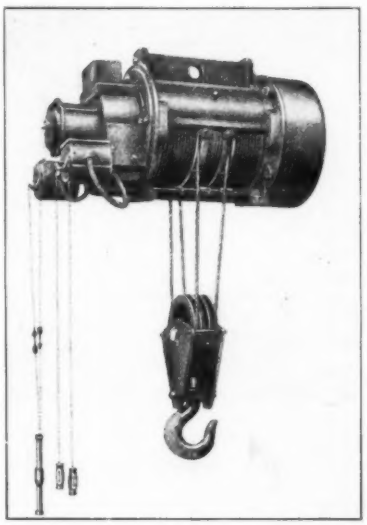

Fig. 1.—Standard Micro-Type Electric Hoist Block.

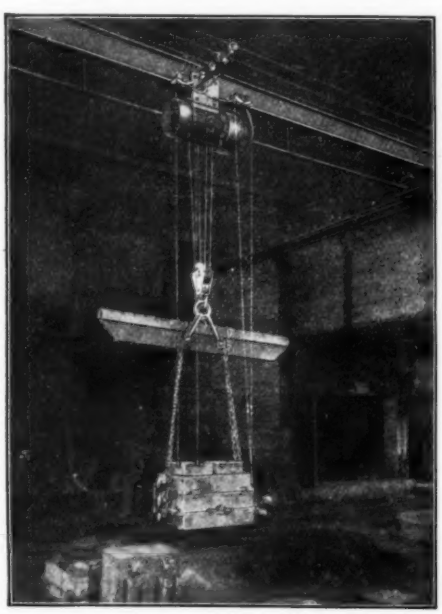

Fig. 2.—Micro-Block fitted with Carriage, for travelling on Joist Runways.

of up to 44 ft. per min., on the same block, combined with a wide range of adaptability.

The micro-block is a self-contained unit. The creeping or micro speed where extremely slow and steady movement is required, such as for starting the stripping of the patterns from the mould, is operated by one controller on the block, and the second speed, which is that of the ordinary standard electric crane, is operated by the second controller. Both controllers may be operated together without the slightest risk of damage, and rapid changes may be made from slow to high or high to slow.

The design and construction of the micro-block very closely follow the lines of the standard electric hoist blocks made by the company, as illustrated generally in Fig. 1, from which will be seen the unusually low headroom required. Two cast-steel end frames are held rigidly in position by transverse steel members forming a cage, and a forged-steel drum having right- and left-hand machined rope grooves and running on roller bearings is carried in the end frames, the diameter of the roller race being equal to the diameter of the drum. In the end of this drum is shrunk and pegged a machine-cut internal gear ring. This gear ring meshes with the main steel pinion projecting from the cast-steel gear box which is fitted to one end frame. Inside this oil-tight gear box are the machine-cut helical gears of special steel which run in an oil bath. The main hoisting motor is housed inside the drum, a shaft carrying the primary drive pinion projecting into the gear box. By this means the motor is completely protected from dust, damp or damage, and the drive is direct and totally enclosed, with the additional advantage of running in an oil bath.

The patent micro-gear with the electro-magnetic main sustaining brake and automatic micro-brake is carried on an extension of the main motor shaft, and fitted to the micro gear case is a flange-mounted micro-motor, the whole of this gear and motor being likewise totally enclosed. Two oil-immersed drum-type controllers are provided, one for the main hoisting motor and the other for the micro-motor, and these can be fitted with hanging chains or lever, according to requirements.

The capacity of the T.M.E.C. micro-blocks is similar to that of the standard electric hoist blocks and winches, being machines to lift loads from 10 cwts. up to 5 tons, with special units lifting up to 10 tons, and a varied description of mountings is available, from the eye-suspension type to those mounted on a trolley for use on runways, either hand- or electrically-travelled, and wall cranes, overhead cranes, etc.

Fig. 1 shows a standard micro-type electric hoist block which can be suspended from any point or the hook of any existing hand of electric foundry crane, whilst Fig. 2 shows the micro-type, which is the standard micro-block fitted to a four-wheeled carriage for push or hand-chain-gear travel on the lower flange of rolled-steel joist runway. A properly-designed runway with the necessary curves, switches and turntables would thus enable the whole of a foundry floor to be covered.

In addition to the electric lifting motion, blocks equipped with electric travel are also manufactured, the travel being effected by a separate totally-enclosed traction-type motor with separate controller, thus providing an entirely power-operated unit which is so simple and fool-proof that it can be put into unskilled hands with perfect safety.

Fig. 3 illustrates an arrangement embodying an existing twin-girder overhead travelling crane and crabs to which is fitted a T.M.E.C. micro hoist block which thus provides at extremely low cost an up-to-date and efficient electric crane, with creeping speeds. On the end frames of the hoist blocks are provided four feet on which the micro-block may either be rested or suspended, and it can thus easily be mounted as a winch or a crab, as illustrated.

The company has a standard range of micro-crabs with either hand-chain cross-travel or electric-motor travel which are adaptable to any existing twin-girder crane at present in use. Single-girder cranes can be similarly modernised by fitting to these one of the standard micro-blocks to run on the lower flange of the existing girder.

Although the headroom required by the standard models is unusually low, yet a specially-low headroom model is also made as shown in Fig. 4, which also shows attached to it a cable-reeling drum and travelling cabin for the operator. This illustration is of particular interest, since it displays an electrically-operated grab suitable for dealing with foundry sand, loam, etc. The operating mechanism is a self-contained unit contained in the upper frame of the grab.

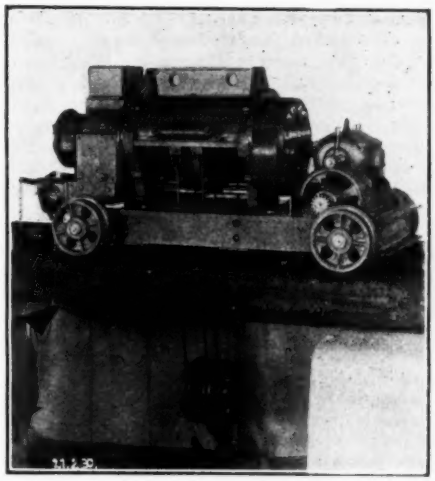

Fig. 3.—A T.M.E.C. Micro Hoist Block adapted for travelling on an existing Twin-Girder Crane Runway.

The totally-enclosed design of all these blocks, together with their all-steel construction, makes them ideal for foundry work, and both the standard range and the micro electric hoisting units have been specially designed for use by totally unskilled labour, the gear being fool-proof in every way, with an automatic, easily-adjusted resetting limit switch to prevent the possibility of overwinding in either direction and having powerful automatic self-sustaining brake gear. The limit switch is actually operated by the rope guides, thereby providing a means whereby the block can be very easily set to a limit at any point in its travel. These guides effectively prevent the ropes from leaving the grooves or becoming crossed.

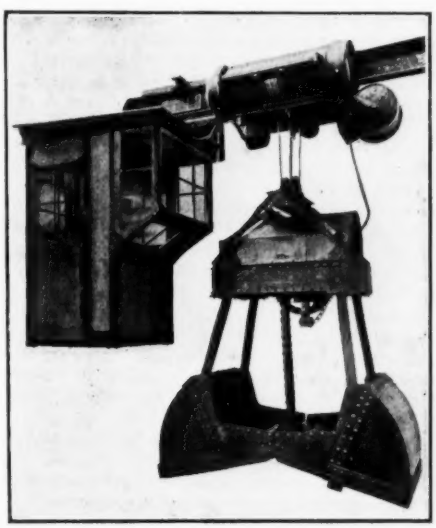

Fig. 4.—A Low-Headroom Model of the Micro-Block, incorporating Operator's Cabin and Cable-Reeling Drum.

Welded Containers.

MATERIALS AND TREATMENT.

The Department of Scientific and Industrial Research has issued the Report of the Committee on Welded Containers.* In their Fourth Report the Gas Cylinders Research Committee submitted recommendations on the subject of the conveyance of liquefied gases in solid-drawn cylinders. Some of the gases considered in that Report, more especially chlorine, are also stored or transported in welded containers which have a much larger capacity and are essentially different in construction from solid-drawn cylinders. The present Report supplements that of the Gas Cylinders Research Committee by recommendations for the material, methods of construction and testing of welded containers for the storage and transport of chlorine, sulphur dioxide, phosgene and ammonia. Recommendations are also made on the amounts of the different gases with which the containers should be charged.

The selection of the steel of which the containers should be made must necessarily be governed by the fact that it should be of good welding quality. It does not appear that any systematic work has been carried out which would enable definite conclusions to be drawn as to the requisite composition and mechanical properties of the best steel for the construction of welded pressure vessels. In view of the body of available practical experience as to material which has been satisfactorily used for the manufacture of pressure vessels, however, it has not been thought necessary to undertake the extensive programme of work which would be involved in an investigation of this nature. Reference may be made in particular to the material used by a British firm having extensive experience of the manufacture of welded drums for the transport of chlorine (A); to the steel used for the construction of tank wagons to the British Railway Companies' specification (B); to the steel specified in Shipping Container Specification No. 27, issued by the U.S. Bureau of Explosives for welded containers of 1,700-lbs. water capacity (C); and to the specifications of the American Society for Testing Materials for Steel Plates of Structural Quality for Forge Welding—Serial Designations A 78—27 and A 89—27 (D). The qualities of these materials are summarised in a table in the report (not reproduced here).

The specifications do not differ very widely, and the Committee have come to the conclusion that the requirements would be satisfied by a steel conforming to the following requirements:—Composition: Carbon, 0.10 to 0.20 per cent.; sulphur, 0.04 maximum; phosphorus, 0.05 maximum; manganese, 0.40 to 0.60; silicon, 0.20 maximum; the balance being iron. Tensile strength, 24 to 28 tons per sq. in. Elongation on an 8-in. gauge length, 27 per cent. (minimum). A detailed specification is given in the summary of recommendations in the Report.

The Report also gives hints as to the formula for calculating the strength of containers.

Manufacture of Containers.

In the opinion of the Committee the most important element in the construction of the containers is the method of carrying out the welding operation. In the construction of the drums which have been used for the transport of chlorine, the welding was carried out by one or other of the three following methods: Water-gas welding, acetylene welding and electric welding. Their use for the conveyance of the gas by rail was discontinued after the war, but more recently the railway companies were asked again to accept them for that purpose. In considering the application, the railway companies decided to submit a number of drums representative of the three types to severe rough-handling tests so as to ascertain their resistance to shock. For the purposes of the tests, the drums were charged nearly full with calcium-chloride solution having a density about the same as that of liquid chlorine, the remaining space being charged with air to a pressure of 93 lbs. per sq. in. to represent the normal pressure in chlorine vessels. The drums were then dropped from various heights ranging up to 10 ft., and at different angles, either on to a concrete floor or on to a transverse rail. It was found that the behaviour of the water-gas welded drum was superior to that of the others. As a result of these trials the railway companies decided to accept, provisionally, drums made by the water-gas welding process. At a later date two more water-gas welded drums of a new design were subjected by the companies to similar tests, again with satisfactory results.

It was important to ascertain how far the differences in behaviour of the various drums under these tests could be related to differences in the welds and in the condition of the material at or near the welds as determined by laboratory methods of testing. Accordingly, all the drums were subsequently submitted to detailed examination at the National Physical Laboratory. It is satisfactory to note the correspondence between the results of the rough-handling tests and the laboratory examination. The latter in every case yielded definite evidence as to the nature of the defect which caused failure in the full-scale trials. It is concluded that high ductility and high Izod-impact values are necessary requirements of welds which may be subject to heavy shocks in service. The Report makes it clear that the water-gas welds were almost uniformly superior in these respects to the acetylene and electric welds. It is important to note in this connection that water-gas welding, as commonly carried out, causes union of the material while it is in a plastic condition. It does not involve the introduction of added material in the fused condition into the joint, and the welding is accompanied by the application of mechanical work by hammering or rolling.

A satisfactory weld of this nature should not differ materially in strength from the original material. Electric welding and oxy-acetylene welding, in which some of the metal is actually fused, belong to a different category. Fusion either of the original or the added material introduces the possibility that the material at or near the weld may be left in a condition comparable with its condition in the cast state, since no mechanical work has been done on the metal in cooling from the fused condition. It should not be overlooked, however, that even with the water-gas welds there was evidence in the majority of cases that the material had been overheated, thus leading to increased brittleness in the tests.

Conditions Desirable for Welding.

The evidence obtained as a result of the above tests points definitely to the following conclusions as to the conditions under which the welding should be carried out: (1) The material should not be heated during welding to a temperature in excess of that required to obtain a satisfactory joint; (2) no extraneous material should be added to the joint; (3) sufficient work should be put into the material while hot to make an effective weld, but forging should not be continued after the material has cooled below about 800 deg. C.; (4) that the overlap, when the edges are brought together for the welds, is of an amount, depending on the thickness of the plates, adequate to provide an effective joint. In the case of drums, attention should also be paid to the following points: (5) That the circumferential flange on the concave end plates fits smoothly into the cylindrical body and is of an extent sufficient to ensure a weld of adequate depth; and that after welding, while the material is still hot, the flange is given a slight inward crimp.

The body welds after completion should be carefully examined both internally and externally. The end welds should also be carefully inspected. Internal as well as external examination of the end welds in a tank wagon is made possible by the provision of a manhole which permits ingress into the vessel. In the case of the drums the concave form of the end plates and the consequent form of the joint make it possible to submit the weld to a fairly satisfactory examination from the outside.

The application of a heat treatment after the welding operations is essential to ensure that the material is left in a satisfactory condition. This should consist in heating the containers in a furnace to a temperature of about 950 deg. C., removing them from the furnace as soon as that temperature has been attained throughout the material and then allowing them to cool in air away from drafts.

Suggestions are made how the completed containers should be tested by hydraulic pressure and by a drop test (for drums only).

* H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. (Price per copy, 1s. 3d. net.)

Foundry Educational Developments.

(*Concluded from page 252.*)

Instead of getting a grounding in mathematics and science, which sounded rather terrifying to the average apprentice, he would get a general grounding in the practical side. Mr. Logan's remarks about the Junior Section were very important, too; they were hoping that it would get a considerable fillip from the foundry classes and they also hoped that there would be no lack of entries for the John Surtees Memorial within a few years as a result of the classes. The Newcastle Branch had never organised a senior competition.

There was no doubt about the wisdom of Mr. Logan's remarks upon visiting other foundries. It was surprising what could be picked up even from foundries doing quite different kinds of work from one's own. He had taken the opportunity of joining the trip to the Paris foundries which had been organised by the London Branch. They were practically all mass-production foundries, and to anyone like himself, who was used to a heavy foundry, their methods had been truly astonishing. Although one could not apply much of what one saw, one received numerous ideas. He proposed a hearty vote of thanks to Mr. Logan and wished to assure him that anything the members could do to support him they would certainly do.

Mr. V. Stobie seconded the vote of thanks, which was passed unanimously.

Mr. Logan briefly replied.

Twentieth-Century Progress.

A cinematograph film was shown, by the courtesy of Messrs. Alfred Herbert, Limited, entitled "The Age of Speed." This film presented the story of grinding and the part it plays in many industries. It showed many scenes depicting the high speed of the age, the Twentieth Century Limited speeding along at 60 miles an hour, motor-car races where 108 miles an hour was averaged; motor-boats skimming along on the water at 82 miles an hour, aeroplanes that reach a speed of 246 miles an hour. Comparisons were made in various industries between the tedious methods of former times and those of to-day, where high-speed automatic machinery is doing the work.

Modern inventions are the result of the ability of modern grinding machines to attain a high degree of accuracy. It is rather common practice to grind work within 0.00025 in. of perfection; such a degree of accuracy makes possible at low cost the many high-speed machines in present use.

The Evolution of Malleable Cast Iron in France.*

By Raymond Gailly.

The malleable industry in France was, in 1914, centred in the Ardennes; therefore, it is not surprising that little progress was made during the war. The personnel was dispersed; for example, automobile castings and agricultural machines were no longer made, and the uses of malleable cast iron were still very limited. The period immediately following the war saw no great progress. The works having been thoroughly dismantled, all had to be reconstructed and were closely engaged upon their reflotation so that they were unable to devote any time to research.

Meanwhile founders' opinions on the composition of the charges had been modified. In pre-war days chemical analyses had then made only brief incursions into the domain of the malleable foundry. The irons were classified according to their place of origin, and even of their nationality. It was recognised that for making good malleable, English or Swedish hematite pig-irons had to be used, but the few foundries of the Centre or of the Midi districts who were able to continue working, not always being able to secure these, used French hematites, and after a more or less prolonged study of the subject discovered that on the whole these could give as good an iron as the foreign hematites. Certain foundries even thought of replacing the iron by steel, by adding to it the ferro-alloys necessary for securing the desired analysis.

It is well known that in the cupola, the iron being in direct contact with the coke, it recarbonises automatically. Malleable can be produced in the cupola by starting with a charge composed solely of steel scrap and ferro-alloys. The coke consumption is naturally increased, and there is difficulty in obtaining an iron of regular analysis, because the least variations in the descent of the charges in the cupola can cause very important differences in the silicon and manganese contents. If the facilities for supplies had been increased and the cost price of the charge diminished, the quality of the metal would remain the same. On the other hand, since 1915, the malleable industry in the United States of America has made great progress. At that time, in France, the normal test-bars gave a strength of 20 tons and 3 to 4 per cent. elongation, whilst in America the average was 22.8 to 23.5 tons and 16 to 17 per cent. elongation. Therefore, several malleable iron founders visited the latter country with the object of studying the new development.

To ameliorate the quality of malleable cast iron, one should first be provided with equipment; a foundry can to-day no longer work without a laboratory. It is equally necessary to procure recording pyrometers, which allow one to control the annealing with precision. To cite an example, the pyrometers the author is obtaining at the moment register the temperature within 5 per cent., and the time intervals being represented by parallel lines of several centimetres distant, the readings are easily made.

Melting Units.

In 1922 there were installed at about the same time in France, two 10-ton reverberatory furnaces for malleable, and after the inevitable teething troubles made necessary by the difference in analyses of the raw materials, results were obtained comparable to those associated with American practice. Then, finding the manufacture of malleable cast iron in the reverberatory furnace too inconvenient, other founders sought to improve the quality of cupola-melted iron, and in ameliorating the composition of the charges and the annealing, commenced upon the manufacture of black-heart in the cupola, which gave on a test-bar of 16-mm. section a strength of about 20.3 tons per sq. in. and 8 per cent. elongation. Many trials were made to avoid the recarburisation of the iron in the cupola up to 3 per cent. carbon, but no single reliable result was obtained. To obviate this inconvenience, certain founders employed the Duplex process, which consists of decarburising the iron produced in the cupola in a converter.

In 1926-27 the reverberatory furnaces were modified, enlarged and changed over to pulverised-fuel firing, the coal being pulverised either in a unit or in a centralised plant. The new furnaces in general were of about 20 tons capacity.

Before transforming his furnaces the author had a test made, using a reverberatory furnace fitted with a recuperator of silico-aluminous bricks. The temperature obtained was very high, but the recuperator, being submitted to too great temperature variations, lasted only for a few days and this process had to be abandoned.

At last, a year and a-half ago, a 1½-ton rotary furnace, burning pulverised coal, was constructed; this experimental furnace was followed by a 5-ton furnace, which is at present being tested. It differs from the German furnaces in that it carries a metal-cased recuperator, which, the builders claim, results in a serious fuel economy and allows higher temperatures to be attained.

Annealing Furnaces.

The annealing furnaces have followed a similar evolution. The old type was the 2-ton coal-fired Ardennais, but even before the war there were in existence some recuperative water-gas-fired furnaces. It was these water-gas-fired furnaces which were rebuilt in 1919. Then, later, furnaces with independent, but grouped, gas producers were built. These could feed interchangeably all the furnaces of a battery. Finally, a few years ago, pulverised coal replaced coke, and the author believes that the greater part of the malleable products in France is now annealed in pulverised-coal furnaces, fed either by the unit system or from a centralised plant.

Furnace capacity has progressively increased; in the author's works, for example, it has grown from 10 to 16, then 24, and finally 30 tons. The furnaces are either of movable or fixed hearths; in this case, charging is effected by electric charging machines.

But not only have the melting and annealing processes and apparatus undergone transformation. In consequence of the lack of skilled labour, hand moulding tends more and more to disappear. The hand machines have been replaced by hydraulic machines, which themselves are being replaced by compressed air. The author does not know whether sand-throwing machines of the Beardsley-Piper design have been employed up to the present in malleable foundries, but they will certainly be used in the near future. The difficulties of recruiting labour have forced founders to consider the problems of handling; the wheelbarrow has been replaced by trucks, then by different types of electric trucks, and monorails and roller conveyors are becoming more and more general. The problem of continuous casting is more difficult to solve in malleable than in grey iron, because, for one thing, of the melting apparatus and, for another, of precautions necessary for the avoidance of allowing the castings to cool too rapidly. It is not insoluble, since it has already been practically achieved in America.

A problem which has as yet received little attention in France is that of synthetic sand. The author does not know of a malleable foundry which uses it; it is true that France does not possess organisations comparable to those of the Americans for carrying out this type of research. On the other hand, automatic or semi-automatic sand plants are developing more and more, as well as apparatus which ejects the sand at high speed. The author does not know of foundries casting malleable in chill moulds; nor has he heard talk of foundries making tests to arrive at casting it in metallic moulds. In each of the ancillary services of the foundry numerous changes and modifications are due to be made.

From the brief description above, it can be understood that the French malleable foundries are in a state of constant transformation. There was a time when the good prophets declared that malleable cast iron was a hybrid product which would tend to disappear, and that it would be replaced either by drop forgings or by steel castings. Evidently certain castings have been replaced by stampings or even steel castings, but the author believes that he is not wrong in saying that many more have taken the reverse direction. The malleable industry is rapidly developing in France. The author is unable to give exact figures, knowing only the outputs of a few works, but he is convinced that he is very much below the real figure in saying that the production is now more than triple the pre-war figure. Malleable cast iron presents a certain drawback: it must be annealed, and the duration of annealing is long and a certain number of auxiliary operations are involved—packing, unpacking, tumbling, inspection after annealing—all of which increases the cost price and lengthens the cycle of manufacture. If the consumption of malleable increases, it is because, by the side of this drawback, there are indisputable advantages.

Technical Progress.

The chief charges made against malleable, before and during the war, can be summed up thus: Malleable is an irregular metal, also, it cannot be used for important castings and, finally, it can only be machined slowly—16 to 18 m. per minute—because of hard spots.

Table I.—*Tests made on Test-Bars with and without Nickel Additions.*

	1. 0.28 kg. of Ni with 50 kgs. of iron.	2. 0.55 kg. of Ni with 50 kgs. of iron.	3. 0.83 kg. of Ni with 50 kgs. of iron.
Test-bar without Ni	T.S., 23.5 tons per sq. in. Elong., 18 per cent.	T.S., 23.2 tons per sq. in. Elong., 18 per cent.	T.S., 23.5 tons per sq. in. Elong., 20 per cent.
Test-bar with Ni	T.S., 25.4 tons per sq. in. Elong., 20 per cent.	T.S., 22.6 tons per sq. in. Elong., 14 per cent.	T.S., 20.3 tons per sq. in. Elong., 12 per cent.

The transformation of melting methods and the amelioration to annealing control have given to malleable that which it lacked—homogeneity and regularity. Its use is now rapidly developing in all sorts of industries. The motor-car industry takes a large consumption, not only for touring cars, but also for important castings for lorries. Agricultural implements and railways use large quantities; it is used in the electrical industry for the supports of high-tension cables, by the textile industry, and in all industries involving mechanical construction.

Machining speeds of 35 to 40 metres per minute are current, and one can machine up to 50 to 60 m. These high speeds can be attained because, independently of the fact that the metal itself is very soft, the castings being cast at a temperature much lower than that necessary for cast steel, blow-holes and slag inclusions are much less common, and sand does not adhere to the surface.

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* Abstract of a Paper read at the Pan-European Foundry Congress at Liége. The author is Director of La Société Gailly Frères at Charleville (Ardennes).

The Growing Load.

By "Kilowatt."

The power demands of a foundry vary with its production, and the management of a progressive concern must at some point in the growth of the business face the problem of meeting an increased power demand. A correct answer to this problem is by no means easy to reach, and a poor decision may load the foundry with an excessive power charge for all time. Under certain conditions, the foundry buying power and producing heating steam in low-pressure boilers begins to see its power problems in a new light when growing production builds the power bill to sizeable proportions.

A point may be reached in this development where it is felt, rightly or wrongly, that locally-made power might be cheaper. This leads to a survey of the whole power situation—often with the co-operation of the supply company. If the final result of this study demonstrates to the satisfaction of the foundry that local generation would be cheaper than purchase of all requirements, the supply company is faced with the loss of a substantial and increasingly attractive block of its load.

Assuming that local generation is actually cheaper in a given case, or at least that the foundry is so convinced, a third possibility is often overlooked, to the detriment of both parties. It frequently happens that the economic solution of this problem is neither local generation nor purchase, to the exclusion of the other. A combination of purchased and locally-generated power may give a lower cost than either alone. It has repeatedly, and correctly, been stated that each plant is a law unto itself, and that no general statement can be made as to the superiority of purchased power over that locally generated, or *vice versa*. Too many factors are present for a general answer.

Factors to be Considered.

There are, however, some generalisations that may be made regarding certain factors. Take, for example, the factor of size—referring to the size of a foundry plant. Increased size means increased load. This, in turn, lowers the unit cost of locally-generated power. It is a truism that the cost per unit of capacity of boilers, turbines, generators and other power equipment decreases as size increases, and that this decrease in unit-investment cost is accompanied by a decreased fuel consumption per 1,000 lbs. of steam or per kilowatt-hour.

Moreover, this fall of unit-investment cost and fuel consumption is accompanied by a substantial reduction in labour and supervision charges per unit of output. It is obvious that the operating personnel and cost of executive supervision for a 1,000-kw. plant may be practically the same as that required for a 2,000-kw. plant. With the same load factor, then, *unit* labour and supervision costs for the 1,000-kw. plant may be nearly double those for the 2,000-kw. plant. The rate of change of these elements with load is far more marked within the range of usual industrial loads than is the case with central stations in the range from, say, 50,000 to 500,000 kw.

So far the size factor works entirely in one direction—in favour of locally-made power as the load increases. Working in the opposite direction is the factor of price of purchased power. As the load increases the cost of purchased power generally goes down. If it went down fast enough, it would, of course, throw the balance more and more in favour of purchased power as plant size increased. In most actual cases, however, the cost of locally-generated power falls more rapidly than the cost of purchased power as the plant and the load grow larger. This is certainly true in practically all cases for very small plants. Thus, if one starts with a small foundry plant, purchasing all power because it is cheaper to do so, increased size makes locally-generated power more attractive. This trend may or may not continue to the point where local generation is actually cheaper.

Let us consider, then, what may happen with the natural growth of a plant originally purchasing all its power and generating steam for heating and process in low-pressure boilers. As the plant grows the power bill grows with it, until eventually the owners turn their attention to the possibility of generating power. The resulting investigation may reveal the fact that a substantial portion of the load can be generated at rather low cost as a by-product of process steam, while additional load generated from steam exhausted to condenser or atmosphere will cost considerably more than purchased power. It may happen that the saving on by-product power will more than offset the higher unit cost of the portion that must be generated by condensing equipment or by prime movers exhausting to atmosphere.

An Economical Solution.

An economical solution in many such cases is a combination of locally-generated and purchased power. The plant under this plan generates all or a great part of the power that can be obtained as a by-product from process steam, and buys its remaining requirements from the supply company at a fair rate which takes account of the rather poor load factor often associated with this excess load.

In short, in the case under discussion, the three primary operating possibilities may be arranged as follow, in order of their economic desirability from the standpoint of the manufacturing plant:—First, generate all or part of the available by-product power from process steam and purchase the remainder; second, generate all power locally; and third, purchase all power. Failure by either the central station or the foundry to recognise the true situation will result in loss to both parties.

Many far-sighted supply authorities now appreciate the existence of this situation and encourage industrial customers to purchase part of their power rather than generate all locally, which would be the second best procedure in such cases. This situation promises to become increasingly common as industrial power decisions are based more and more on economic analyses. It is obviously proper in such cases for the company to charge a higher rate for energy because of the smaller amount used and to take care of lower load factor through equitable demand charges.

A.C. or D.C.?

The question as to whether alternating current or direct current is the more economic supply system for foundries is one that has been frequently debated, and, broadly speaking, no general rule can be laid down in the matter. It was the earlier practice for foundries to operate with direct current, having regard to the numerous motors for hoisting, and even to-day the view is widely held that direct current should be given precedence on this score. There is, however, no fundamental reluctance to three-phase, for there are now various possibilities of motors for this system of supply. It is, nevertheless, imperative for foundries which do not generate independently, but purchase their current in the form of three-phase from a public electricity works, to make comparative calculations as to the economy of direct and three-phase current. A computation of this character will prove that the total running costs with speed regulation depend upon the time during which the unit runs at reduced speed. The three-phase induction motor with resistance control is the more economic drive in many cases, provided it has to run at a reduced speed for a comparatively short time only. In three-phase systems, the selection of direct-current variable-speed motors demands the installation of a three-phase direct-current converter. This equipment, however, occasions continuous losses, added to which the outlay on interest and depreciation are much more pronounced than if induction motors were selected, which may be ascribed to the higher initial costs. The total running costs, comprising the cost of current and the outlay on interest, can therefore in certain cases be higher in a three-phase plant with partial convertion to direct current than in a pure three-phase plant, despite the higher costs for current ensuing due to the dissipation of the energy in the resistances when regulating the speed of three-phase induction motors. This case can occur when operation is effected at a reduced speed for a relatively short time—based on the total number of operating hours. Nevertheless, having regard to the stocking of spare parts for the motors, it is prudent to avoid the installation of several supply systems unless essential. The inclusion of a converter in a three-phase system can also be evaded by the selection of three-phase commutator motors, for with this type it is possible by brush shifting to achieve infinitely variable-speed regulation which is not inferior in effect to the regulating qualities of direct-current motors. The extremely simple construction of the three-phase induction motor should nevertheless be seriously studied when deciding on the system of current.

The Evolution of Malleable Cast Iron in France.

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Nickel Additions.

Progress continues, and still higher results can be visualised for the future. The author having been asked to cast test-bars with a nickel addition, a certain number of tests were made, but, as will be seen from Table I. only the first test gave satisfactory results. Unfortunately, the cost price of metal is considerably raised, and the advantages obtained are not sufficient to allow of nickel additions in practice.

A test also was made with Ni and Cr additions (0.83 kg. Ni and 0.4 kg. Cr), and the following tests have been made with test-bars and castings:—

(1) Test-bar after first annealing, still hard and brittle. Links of chain 33 after first annealing; strength slightly higher than that of the chain cast with Ni-Cr (fracture between 390 and 420 kg. instead of about 370 kg.).

(2) Test-bar after second annealing, still hard and brittle. Links of chain 33 after second annealing; fracture between 420 and 450 kg.

It seems, therefore, that for this type of casting, that is to say, for castings of 2 to 3 mm., the use of Ni-Cr slightly increases the strength. On the other hand, for castings of greater thickness than 3 mm. annealing has little effect.

The test-bars on which the tests have been carried out are of 16 mm. chain, and the elongation is measured on 50 mm. The nickel addition is made by throwing shot into a ladle at the spout of the reverberatory furnace, the test-bars without nickel being of the same cast.

In addition to strength and elongation there are other characteristics of malleable which can be ameliorated; tests with additions of other metals can be tried out for increasing, for example, rust resistance, or for diminishing hysteresis.

Notes on the Behaviour of Sand Moulds in Steel Foundries.*

By Paul L. Goodale.

It is the purpose of this Paper to draw attention to the importance of the surface oxide, when casting steel in sand moulds. It is self-evident that the burning of liquid steel always occurs on its surface, whenever it is in contact with the atmosphere. Since the sand mould for a casting is permeable, atmospheric pressure supplies the requisite oxygen for combustion of some of the steel cast in it. When molten steel is poured into a mould constructed so that a surface of the liquid metal is exposed to the air, certain phenomena always manifest themselves. The incandescent iron burns at the surface exposed to the air, combining chemically with the oxygen, forming a compound known as iron oxide.

Fig. 1 is a drawing of the cross-section of the upper part of a steel ingot. The oxides are designated as A and B. A is the first oxide formed. It has a different coefficient of expansion than that of the steel beneath, and therefore flakes off, again leaving the steel surface exposed to the air. The surface is now cooled to about cherry redness, but is still hot enough to burn slightly to form oxide B, which adheres very tenaciously. The oxide A was found to be a mixture of ferrous and ferric oxides, analyses of which gave results of which the following are typical:—Fe_2O_3, 34.60; FeO, 62.31; and MnO, 0.92 per cent. The oxide B was found to be pure FeO.

Experiments with Special Cores.

A series of experiments was made to demonstrate surface burning, by making a very porous core, using sifted sand free from fines and mixing with it 5 per cent. sodium silicate as a binder. This fastens each sand grain by glassy adhesion, after the core has been baked. This experimental core, 4 in. by 4 in. by 2 in., was placed in a large mould. After the steel had been cast against it, the metal was found to have an oxide attached, having a thickness of ¼ in., which had to be prised off the casting. This may be explained by the fact that, due to its permeability, the core absorbed the oxide capillarily as fast as formed, thus cleaning the surface of the metal adjacent to it, so that it was free to burn (act chemically) with all the oxygen it needed until the metal cooled to a temperature where such action ceased. (See core A in Fig. 2.)

Fig. 1.—Diagram of Surface of Steel Ingot.

(A)—Oxide surface, a mixture of ferrous and ferric oxides; (B)—Thinner inner oxide surface composed of pure FeO.

Another core of the same dimensions as above was made from zircon (zirconium silicate) bonded with a very small amount of sodium fluoride, producing after ignition at red heat a core that was practically airtight. The core was placed in the mould in the same position as was the original core. The oxide formed on its surface was noticeable only as a few small black spots. The experimental cores were white in colour, and the depth of iron oxide penetration, which is dark brown to black in colour, therefore was easily observed in both instances. (See core B, bonded with zircon, in Fig. 2.)

Observations.

Ferrous oxide melts at 1,420 deg. C. Inasmuch as the molten steel had a temperature of 1,630 deg. C., it is evident that the temperature about 1,420 deg. C. caused the ferrous oxide to be extremely fluid, thus accounting for its filtration through silica washes, and for its absorption by a porous core-sand mixture. There is a secondary chemical action that often takes place between the iron oxide and the silica, depending, of course, on temperatures involved. Sand and iron oxide are substances that are chemically opposite in nature. These tendencies are accentuated by the molten steel in close contact. The reactions involved may be understood by referring to sketches Nos. 1, 2, 3 and 4 in Fig. 3.

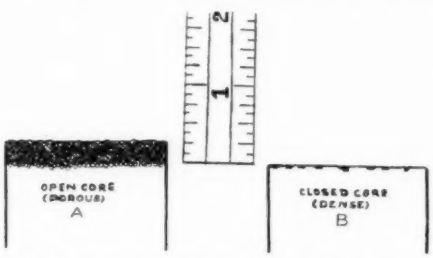

Fig. 2.—Slag Attack on Two Cores.

(A)—Open porous core bonded with 5 per cent. sodium silicate; (B) zirconium-silicate core bonded with sodium fluoride, producing a practically airtight mixture. The relative amounts of oxide surfaces on the two cores are shown.

Sketch 1, at the left of Fig. 3, represents steel just cast against a core surface. There is an expansion of air in the core, and the flow of air is away and out. The molten steel is illustrated as a heavy solid line. Sketch 2 illustrates the condition a few seconds later than that shown in Sketch 1. The casting surface begins to burn, forming iron oxide. This oxide, as previously stated, melts at 1,420 deg. C., and is extremely fluid at the temperature of the metal as cast, which is slightly less than 1,650 deg. C. The oxide is illustrated by diagonal lines. Sketch 3 shows the condition a few seconds later than that illustrated in Sketch 2. The iron oxide reacts chemically with what are now very hot sand grains to form iron silicate, illustrated by crossed diagonal lines. Its melting plant is about 650 deg. C., much lower than that of iron oxide, with which it is mixed.

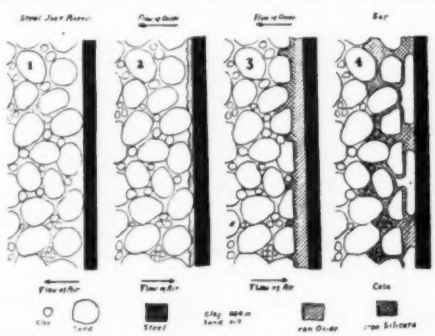

Fig. 3.—Various Stages of Penetration of Oxide into Cores.

The sand grains at the surface often are eaten off flat, as can be seen under a microscope having ten magnifications. A flow of the iron oxide silicate mixture into the core also is illustrated. Sketch 4 of Fig. 3 shows the final core surface, where most of the iron silicate—mixed with ferrous and ferric oxides of iron—is drawn by capillary attraction into the core, in extent depending upon its porous condition. Points of contact show evacuating spaces between these points, all visible under a low-power magnifying glass. Sand from surfaces of steel castings often contains 25 per cent. of absorbed oxides.

Magnetic Core Surfaces.

It is interesting to find that specimens of core surfaces that peel away from the castings often are found to be magnetic. This does not happen in green sand, but is a common occurrence with baked core sand. As the oxides and the silicates penetrate more deeply into the core, they encounter carbon formed by the destructive action of heat upon the bonding materials used in making the core. This carbon has a reducing action, similar to that in the blast furnace, where oxides are chemically reduced to metallic iron. In the case of dried cores, iron oxides flow into the interstitial spaces between the sand grains and there deposit metallic iron, which is sometimes found as a network of the shapes corresponding to the interstices into which it ran. These can be seen microscopically when the mass of a magnetic core is gently crushed, and these little iron anchors are separated by a magnet.

Fig. 4.—Magnetic Characteristic of a Core Surface with Penetrated Iron (2) formed from Oxide reduced by Carbon of Core Binders.

When the interstitial network of metallic iron coalesces, scabs are formed and are often quite large and as far back into the core as ½ in. To the eye they appear as fused metal with sand adhesions. Should the magnetic surface of a core be broken into three parts, one of which is digested in an alcoholic solution of hydrofluoric acid (1:3) overnight in a warm place and then washed free from acid, the silica will be dissolved, leaving the metallic iron interstitial network. A microscope will reveal rounded holes, where the sand grains were originally. The mass is very magnetic. (See Sec. 3 of Fig. 4.) When one of the other parts is extracted with warm hydrochloric acid to dissolve the metallic iron, interstices may be seen where the metallic iron penetrated it. The mass consists of sand and is non-magnetic, as shown in Sec. 1 of Fig. 4. The third or remaining part represents a conglomeration of the two materials described. This third substance is magnetic because of its iron content. This is illustrated in Sec. 2 of Fig. 4.

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* A Paper read before the Cleveland Convention of the American Foundrymen's Association.

Notes on Metal Patterns.

By "Vallishe."

Metal patterns are used in the majority of foundries to-day. Even in jobbing foundries this class of pattern has found great favour. Although metal patterns cost slightly more than wood patterns (this is questionable in the long run) the advantages claimed for the former are many. They keep their shape during constant use; they cannot warp, produce a sharper casting, and are less liable to breakages and dents.

The most common metals used in making such patterns are cast iron, brass, aluminium and white metal. In isolated cases mild steel is occasionally used, but hardly warrants inclusion in the above list and can rightfully be ignored. It is somewhat interesting to compare the physical advantages of the respective metals as applied to use in patterns. A brief survey of their characteristics and advantages is outlined in the following.

Cast Iron.

A close-grained iron should always be used, but care must be exercised in that the metal is not too hard. A soft metal is generally preferred, as it renders the operation of finishing the pattern a much easier task. Many foundrymen dislike using cast iron for patterns because of its liability to rust. Such a defect can be quite easily remedied by the following operations. First finish the pattern in the usual way as though for immediate use. Next damp the pattern all over with a solution of water and salt and allow to rust overnight. Give the pattern another dose the following morning and allow to stand for about three or four hours. Following this the patterns should be dried with a gradual heat and the rust removed with a fine scraper or soft brush. Next apply melted beeswax with a brush (camel-hair preferably) and when finished allow the pattern *gradually* to cool off and rub the pattern all over with a smooth, dry cloth. It should be thoroughly understood that unless the pattern is sufficiently hot to allow any surplus wax to run off, a good finish cannot be obtained. Providing that each operation is carefully executed and a little common sense used, there is no reason why a perfectly smooth surface should not be the case. With such a surface a perfect draw from the mould is easily obtained, with the result that the quality of the resultant casting is of a higher degree. It should also be mentioned that a cast-iron pattern finished in this way is not liable to rust under average conditions and will possess this characteristic for a considerable time if given fair treatment. For large patterns (such as gutter patterns of heavy section) the above method of treatment is not recommended, although in many cases it would prove far from being a failure. No given rule can be stated governing the sizes of patterns applicable to the above treatment, and thus one has to use judgment. Perhaps its cheapness has much to do with the popularity of cast iron for patterns, whilst the physical properties of cast iron are ideal. Again, it keeps work in one's own shop and provides at least one moulder with work. Perhaps ironfounders are somewhat conservative in their views, but allowing this to be the case, one cannot deny that cast-iron patterns are more extensively used than any one other metal pattern at present used.

Brass.

Brass, as a metal for patterns of small proportion, claims many advantages. It does not rust, is durable and strong, and gives a smooth, fine surface when finished. For small and intricate patterns it is almost irreplaceable, inasmuch as it can be quite easily soldered, thus making the building up of an intricate pattern a far easier task than with most other metals. The following mixing has been found quite suitable for patterns: Copper, 82 per cent.; tin, 11 per cent.; zinc, 7 per cent. The proportion of zinc may be slightly increased if desired. For high-grade patterns, however, the zinc should hardly exceed 3 per cent., and the copper 88 per cent.

White Metal.

The term "white metal" is often misunderstood, and it is doubtful if the average foundryman really knows what alloys it is made up of. Alloys of zinc, lead, copper, bismuth, antimony and tin are all termed "white metal." Table I outlines several "white-metal" mixings suitable for various classes of patterns:—

Reference letter.	Cu.	Pb.	Zn.	Sn.	Sb.	Bi.
M	3	—	—	86	11	—
N	—	70	—	17	13	—
W	1	40	1	40	15	3
V	—	80	5	—	15	—
K	—	82	1	8	9	—

The most expensive mixing is M, but it gives a hard and durable metal. The contraction is under $\frac{3}{32}$ in. to the foot. Alloys N, V and K are very popular and are much cheaper than M and W. They are rather on the soft side, making them easy to finish. In regard to lasting qualities, however, they are not half so durable as brass or iron patterns. Alloy W is also a popular metal for patterns. Its contraction can be regarded as nil, and thus, when duplicating is required, it is the most suitable of the five mixings given above. The introduction of bismuth into alloy W is, of course, done to reduce contraction to a minimum, and, coupled with such a high percentage of antimony, its durability is made almost certainty.

Aluminium.

Where lightness of weight is the chief factor of consideration, aluminium holds pride of place. In addition to its surprisingly low weight it can claim numerous advantages, viz., very little finishing of the pattern is required, cannot rust, hard and durable. Soldering, however, is not applicable, and it is here that brass can claim the advantage. Zinc is generally added to the aluminium (up to 8 or 10 per cent.), and, although it adds little to the weight, the resultant metal is much harder than with pure aluminium.

Although it may seem somewhat contradictory to the title of this article, the writer cannot pass without mentioning plaster of paris as a substitute for wood patterns. In the case of a "one-off" job, plaster of paris saves much expenditure, as would be involved with making a wood pattern. For any further use it is of no practical use whatever. Everyday experience in a moulding shop shows one that such patterns will not stand the hard usage meted out to them. The writer has seen plaster-of-paris patterns which, after only having been used once, are almost beyond reclamation. Perhaps the chief damage is done through using too big a lifting iron—a fault from which the average moulder cannot get away. Thus plaster of paris cannot be placed in the same category as the metals previously dealt with, and should be entirely ignored for anything approaching repetition work.

Finishing Metal Patterns.

The finishing of metal patterns calls for great care and exactitude. A pattern which contains blowholes should be immediately scrapped. So much depends on the pattern that nothing should be spared in endeavouring to produce a pattern of the highest order. The finisher should be fully acquainted with the tapers required for drawing the pattern, and in this respect such is not always the case, except in large shops where men are specially allotted to that one job. "If a job's worth doing it's worth doing well," and if that spirit is adopted one can assuredly hope for a job which will withstand the closest inspection and criticism.

High-Pressure Marine Boilers.

A party of engineers, shipbuilders and owners were the guests of Messrs. Babcock & Wilcox, Limited, of Renfrew, at a recent demonstration of the efficiency of high-pressure steam boilers such as were installed in the Clyde turbine-steamer "King George V." The party first inspected the works under the guidance of Sir Robert Dixon, one of the directors. They were specially interested in the boiler plant erected for experiments in the production of high pressures and the use of pulverised fuel. The party afterwards sailed for about five hours in the "King George V," where they saw in operation water-tube boilers capable of developing 560 lbs. per sq. in. pressure of steam, the highest in use at present in any marine boiler.

Speaking at the luncheon on board, Sir Robert Dixon said that it was imperative that full advantage be taken of the fuel resources of the country, not only from the point of view of the coal industry but also in the national interest of the large number of processes proposed for the development of the use of coal. The one in which they were particularly interested was of powdered fuel. A number of firms, including his own, were working at the problem, and he believed had now a proposition that could be recommended for any marine service. In order that they might compete on better terms with the internal-combustion engine, they felt that with the use of powdered fuel the efficiency of the steam engine generally had also to be improved. This would necessitate an increase of steam pressure and also temperature. If that was achieved, water-tube boilers would be necessary, and in that direction for a number of years endeavours had been made to secure satisfactory conditions for high pressures and temperatures.

Sir Charles Parsons returned thanks on behalf of the guests to Messrs. Babcock & Wilcox for showing them the latest improvements in high-pressure boilers and pulverised fuel. They recognised the desirability of using home-produced coal rather than buying oil from abroad. The use of coal might tide them over the post-war crisis, but the advent of the Diesel engine had rendered necessary every effort to improve steam-engine efficiency. The "King George V" was built as a pioneer vessel to demonstrate the use of high-pressure steam—560 lbs. per sq. in. boiler pressure—and she had justified the courage of her builders, Messrs. Denny Bros., and her owners, Messrs. Turbine Steamers, Limited. The economy of the steam engine would equal that of the Diesel engine if the pressure could be raised to 1,000 lbs. per sq. in. The first cost would be in the ratio of about 3 to 2 in favour of the steam engine. He hoped that in a few years all our large ships would be propelled by steam engines working at 1,000 lbs. or even higher steam pressure.

Notes on the Behaviour of Sand Moulds in Steel Foundries.

(*Concluded from page 257.*)

Deductions.

The data here reported were assembled in attacking the problem that confronts those who cast steel against sand. It had been thought that the sand used was not refractory enough, and much time and effort were spent to obtain more refractory mixtures. Oxide formation and action should not be overlooked in attempts to solve such problems. Spraying of metal to close core surfaces, exclusion of air, displacement of air with inert gases, and oxidising agents incorporated in sand mixtures (because higher oxides adhere less tenaciously than does ferrous oxide), are some of the expedients which suggest themselves to the author as meriting investigation. It is hoped that there will be reported to the steel-casting industry results of many researches of more comprehensive and instructive nature than those here presented.

XUM

How the Consular Service Can Help Exporters.

ADDRESS TO LONDON IRON AND STEEL EXCHANGE.

The monthly luncheons of the London Iron and Steel Exchange were resumed at the Great Eastern Hotel, London, on Tuesday, September 16. Mr. Watson Slack was in the chair and the speaker was Mr. E. G. Cable, who at present is British Consul at Portland, Oregon, and has previously been British Consul in Iceland and at Oslo and Danzig. Mr. Cable, who is on holiday in England, addressed the members of the Exchange on the question of "How Consuls can Help British Exporters." He suggested that greater use should be made of the British Consular and Diplomatic Commercial Service abroad, and his address gained added interest from a speech on similar lines made a short time ago by Mr. G. M. Gillett, M.P., the Parliamentary Secretary to the Department of Overseas Trade, who urged traders in this country to take fuller advantage than they do of the facilities offered by his Department.

Consul's Commercial Duties.

Mr. Cable, after a rough outline of the nature of the personnel of the British Consular and Commercial Diplomatic Service in foreign countries, said that there was nothing, within reason, which a British Consul could not do for a countryman of his abroad, and by no means the least important were his commercial duties. These consisted of reporting home at once any openings for trade he came across, and of assisting British manufacturers or traders, or their representatives, who might visit the town or district. There were two ways in which the British Consul could be made use of in this connection. One was by a personal visit of a member of a firm or their traveller. In this connection he recommended anyone contemplating making a trip to any country first of all to find out from the Department of Overseas Trade or the Foreign Office, or in any other way, exactly where Consular officers or Commercial Diplomatic officers were posted. Then a letter should be written to each one of them, stating the nature of the business and the probable time the person concerned would call on the Consul. If the firm whose representative was making the visit had an agent in the town, the Consul should be asked for any information as to his reputation and standing, financially and otherwise, and whether he was well introduced among possible customers. If the firm had customers in the town, they could ask the Consul whether they were people of standing, financially and otherwise, and were they reliable. If the firm had no customers in the town or district, the Consul should be asked to suggest some possible ones.

Detailed Information.

Furthermore, the Consul should be asked what trade had been like in the particular article during the past year and what was the general tone of the market. Another thing that should be asked in these communications to Consul prior to a visit of the kind mentioned, was whether there were any new Customs regulations governing the sale of the article dealt in and whether there were any Government regulations tending to hamper or favour the particular business. Further, it could be asked whether the Consul could suggest any particular points about the article dealt in. It was essential, however, to ask the Consul precisely what it was required to know, because the Consul was not an expert. If information of the character outlined was asked for about two days before the caller arrived, he could rely upon it being ready for him when he did call on the Consul, and very often a shorter time would suffice. It frequently happened that travellers suffered under some disability through the whole of a visit due to some little thing which the Consul, had he been visited, could have put right at once or would have mentioned in conversation as a matter of course. On the other hand, he had received letters from leading firms in this country showing how much they appreciated the information which was readily available for their traveller who had taken the trouble to adopt the method he had suggested.

Written Communications.

As regards dealing with Consuls abroad by correspondence, Mr. Cable said that when a representative of a firm could not visit the town or district abroad and yet wished to find out points with regard to trade, etc., a visit should be made to the Department of Overseas Trade in London. If the matter was urgent, it would be best to communicate direct with the British Consul or Commercial Diplomatic Officer in question. At the same time, it was no use writing, as was often done, just asking what the market was like and could the Consul do anything. Ninety-nine out of one hundred Consuls had no idea of the technicalities of the iron and steel trade, and therefore it was essential, when writing, to give the fullest possible details of the requirements. The writer must say the article he was dealing in, whether he was a manufacturer or merchant, precisely what the article dealt in was and what it was used for, the class of people to whom it was desired to appeal, and generally give the Consul all possible assistance. Possibly the article in question would be higher in price than a competing foreign one, and in that case it should be explained to the Consul why it was higher in price and why the particular article was worth the higher price. There were many points which should be enumerated in any such letter to a British Consul abroad, and his advice to firms was to make the letter a questionnaire, so that the Consul would have the fullest information on all aspects of the inquiry, and could go to expert people in the country in which he was residing to obtain the information desired. In that way it was possible to get a complete report on a particular trade in that country.

In conclusion, Mr. Cable expressed his conviction that we had, in the British Consular service abroad, the finest machinery of its kind in the world, and he urged business men in this country to make much fuller use of it than was the case now. The foreigner held the British manufacturer and trader in the highest esteem, and an asset like that should not remain unutilised.

Carbon and Sulphur in the Cupola.

When in 1927 Mr. James T. Mackenzie, of the American Cast Iron Pipe Company, presented his Paper, "Some Properties of Coke affecting the Cupola Melting of Steel," before the Institute of British Foundrymen, he indicated that there was an equilibrium point for total carbon content in the resultant metal in any given set of cupola conditions. In the September Bulletin of the American Foundrymen's Association Mr. Mackenzie publishes, using numerous tables and diagrams, an extension of that research to cover sulphur absorption, and the effect of repeated meltings, taking cognisance of compositional variations, Brinell hardness and chill depth. Mr. Mackenzie summarised his results as follow:—

Different cokes have a considerable influence on the carbon of the molten iron. In general, the ash content is a large factor, but differences of 3 or 4 per cent. ash can be quite overshadowed by differences in the burning rate or other characteristics of the coke.

For ordinary cokes, the higher the temperature, the lower the carbon-equilibrium point. This probably is not true at either extreme of temperature, for pitch coke gives both high temperature and high carbon, while it is well known that a temperature low enough to cause oxidation gives low carbon. Whether this is due to oxidation during melting, or to reactions with the slag, is not known to the writer.

Some cokes did not give the same carbon, irrespective of the original carbon content for the number of melts tried. In other words, the tenth melt of a pig-iron still had higher carbon than the tenth melt of a steel charge. Some cokes, however, gave the same carbon on the fifth melt of both pig-iron and steel.

The "time for 250-deg. rise" in the burning test was high on the coke giving the highest carbon (except for the pitch coke). It showed a minimum carbon at 2.6 min. There were not enough points on the curve to be sure of this.

Sulphur increases with the sulphur of the coke, *all* other things being equal.

Manganese has a strong influence on the sulphur, especially around a critical point which depends on the other constituents of the metal and on the sulphur and burning characteristics of the coke.

The manganese-sulphur product tends to remain constant with a given coke. It is raised by ferro-manganese additions and increases with the temperature.

Carbon and sulphur are mutually repellant. A high-sulphur iron is difficult to carburise and, on the other hand, a low-carbon iron absorbs sulphur readily.

A coke which gives low carbon gives a higher sulphur absorption than one of the same sulphur content which gives high carbon.

It is our duty to remark that there were a number of variables in these tests which are not entered in the log. The moisture and temperature of the blast, the skimming (or lack of it) of the iron, the size and shape of the pigs, the not-infrequent scaffolding of the small cupola, and the occasional boiling in the pig beds are a few of them which may have affected seriously some of the melts, and even a large part of a whole test. Any obvious occurrence was noted and none of them seems to affect the results; but it is well to realise that such things may have upset individual results here and there.

It should be noted carefully that this cupola is very small and the distribution of the tuyeres rather poor. Whether the latter has much effect is doubtful, but there is little doubt that the importance of different characteristics of coke and blast can change greatly with change in the size of the cupola. In fact they may easily reverse the direction of their action. Thus, while the shatter test does not seem to have any significance in the 18-in. cupola, there is no question about its value in the operation of a 72-in. cupola.

The burning test seems a promising method for the evaluation of coke. The three values reported from the tests varied so consistently with each other on these particular five cokes that it was only necessary to plot against one of them—the most convenient being the "time for 250-deg. rise." Probably a determination of the reactivity of the coke with respect to carbon dioxide, which would furnish information as to the behaviour of the coke above the melting zone, would give valuable information in conjunction with the burning test, although it is of very little value when used alone.

Iron and Steel Production.

The National Federation of Iron and Steel Manufacturers, in their Statistical Bulletin for August, report that iron and steel production experienced a further decline in August, steel production falling to 451,300 tons, a figure which is lower than in any month in recent years, except those affected by the coal stoppages of 1921 and 1926. The number of blast furnaces in operation fell by one to 104, and the production of pig-iron fell to 416,700 tons compared with 682,000 tons in August last year. In spite of the very low prices to which Continental material has fallen, imports in August amounted only to 195,400 tons (or 60,000 tons less than in August last year). Exports of iron and steel fell from 303,400 tons in July to 218,800 tons in August, which is the lowest figure reached since December, 1926.

The Board of Trade's price index number for iron and steel in August fell to 112.0 (1913=100) compared with 112.7 in July and 114.9 in August last year. The index for "all commodities" declined to 117.8 compared with 119.2 in July and 135.8 in August last year.

Returns received from 136 firms employing 69,369 workpeople in August showed a decline of 802 compared with July and of 16,981 compared with August, 1929. According to returns received from 138 firms employing 102,825 workpeople, the average weekly earnings in July amounted to £2 17s. 10d. compared with £2 16s. 6d. in June and £3 0s. 7d. in May.

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Trade Talk.

Mr. Ernest Pearce, carrying on business at 208, Rockingham Street, Sheffield, steel manufacturer, is paying a first and final dividend of 1s. 0½d. in the £.

The Metropolitan-Vickers Electrical Company, Limited, announce a change in the address of their Bristol office, which is now at 22, Victoria Street, Bristol.

The North British Locomotive Company, Limited, Glasgow, have received an order to supply 19 locomotive boilers for H.H. the Nizam's State Railway.

British Metal (Kingston), Limited, is being wound up voluntarily. Mr. G. H. O. Stephenson, 47, Eden Street, Kingston-on-Thames, is the liquidator.

Messrs. J. H. Tucker & Company, Limited, electrical accessory manufacturers, of Tyseley, Birmingham, have removed their London office to 22-23, D'Arblay Street, W.1.

Messrs. Craven Brothers (Manchester), Limited, have opened a branch office to serve South Wales at Western Mail Chambers, Cardiff, under the control of Mr. W. R. Wheeler.

The output of the Belfast shipyards for the first nine months of the present year has been the largest since 1919. Twenty-one vessels, with an approximate tonnage of 138,000 tons, were launched.

Messrs. William Smith & Bros., Limited, of the Sun Ironworks, Heywood, Lancs, textile engineers and ironfounders, have decided to close down indefinitely owing to trade depression.

The Master Cutler, Mr. A. K. Wilson, who is at the head of the Sheffield industrial mission to South America, states in a cable from Buenos Aires that the potentialities for British business in South America are far greater than is appreciated at home.

At the general meeting of the Société des Aciéries de Longwy, held on September 23, a profit of 51,867,000 fcs. was reported for the financial year 1929-30, as against 50,423,000 fcs. for the previous year. The dividend was fixed at 80 fcs. (16 per cent.).

Messrs. Clarke, Chapman & Company, Limited, Gateshead-on-Tyne, have secured a contract to supply marine auxiliary machinery to vessels for the P. and O. Line building at the Govan yard of Messrs. Alexander Stephen & Sons, Limited. The contract is estimated at about £20,000.

General Dawes, the American Ambassador, and Lieut.-General Sir T. E. Clarke visited the Belfast works of Messrs. Harland & Wolff, Limited, on Friday, September 26. They were received by the chairman, Mr. F. E. Rebbeck, and Mr. Chas. Payne, managing director, and were shown over the shipyards and engineering departments.

Messrs. Petters, Limited, Yeovil, have recently supplied three of their heavy-oil engines for operation in the Far East, two of which are 40-b.h.p. single-cylinder units for the Cochin Lighting Plant, and one a 80-b.h.p. twin-cylinder unit, coupled to a 50-kw. Crompton-Parkinson generator, for the Rodier Mills, India. The company have also supplied four oil-engine electric-generating sets to the Irak Petroleum Company.

It was announced in our issue of August 7 that the French Société de Métallurgie Basset reported a further loss of 10,711 fcs. for the year 1929, which brought the total loss up to the end of the last financial year to 119,919 fcs. It is now reported from Paris that an extraordinary general meeting of the company has authorised the directors to raise the share capital to 12,375,000 fcs. by the issue of "B" shares of 500 fcs. each. The chairman explained that the new capital was required for building new iron and steel works for the Société Française des Aciéries Basset.

Prince and Princess Takamatsu of Japan visited the works of Messrs. Hadfields, Limited, Sheffield, on Friday, September 19. They were welcomed by Sir Robert Hadfield (chairman of the company), Mr. P. B. Brown (deputy chairman), Major A. B. H. Clerke (managing director), Mr. J. P. Crosbie, Mr. W. B. Pickering, Mr. W. J. Dawson and Commander E. H. M. Nicholson (directors). Messrs. Hadfields, Limited, have had a long association with Japan, and the visitors were able to see the manufacturing operations on work now in hand for the Japanese Navy.

A cable from Bombay states that at the annual meeting of the Tata Iron & Steel Company, Limited, the chairman announced that the Government had agreed to pay the company 130 rupees (195s.) per ton on all rail purchases instead of 110 rupees as provided in the contract. The Government of India has directed the Tariff Board to inquire and report whether galvanised iron and steel sheets of British manufacture are being imported at such a price as is likely to render ineffective the protection which the Tata Iron & Steel Company enjoys, and, if so, in what form and for what period the additional protection required should be given.

At the opening meeting of the Royal Philosophical Society of Glasgow, held on October 1, Prof. James Kendall, of Edinburgh, delivered a lecture on "The Metals of the Rare Earths." It was explained that a new and very rapid method of separating the rare-earth metals had been developed recently in the laboratories of Edinburgh University which may possibly lead to the discovery of commercial applications of the rare metals in the near future. Thorium and cerium, which are closely associated in the rare earths, can already be readily separated. The lecture was delivered under the Graham Trust, founded in honour of Thomas Graham, who was Master of the Mint.

The winter programme of the Institute of Metals includes over 40 meetings, to be held in metallurgical centres throughout England, Scotland and Wales. The programmes of the various sections have been drawn up to meet the special needs of local industries. Among the subjects dealt with are metals and alloys of the future, metallurgy of some of the rarer metals, magnesium alloy castings, gases in metals, the extraction of copper, chromium plating, the applications of nickel in industry, unsoundness in metals, wire drawing and applications of copper to the building trade. Works visits are also announced, as well as practical demonstrations of metal working in the lecture hall. The President of the Institute, Dr. Richard Seligman, will read the opening Paper before the London Section on "Some Non-Ferrous Metals in Chemical Engineering," and will also contribute, in Glasgow, to an "Aluminium Review" that has been arranged by the Scottish Section. Next year's autumn meeting, it is announced, will take place at Zürich. In 1929 the Institute met in Düsseldorf, and for 1932 a visit of members is being arranged to Canada and the United States. Copies of the programme can be obtained on application to the Secretary, Mr. G. Shaw Scott, 36, Victoria Street, London, S.W.1.

Reports and Dividends.

Babcock & Wilcox, Limited.—Interim dividend of 7 per cent., tax free.

Bengal Iron Company, Limited.—Dividend of 7½ per cent. on the preference shares.

Callender's Cable & Construction Company, Limited.—Interim dividend of 5 per cent., less tax.

Zinc Manufacturing Company, Limited.—The first accounts, covering the period from incorporation (April 19, 1929) to June 30 last, show a loss on trading of £38,857, and a total loss of £47,184, which is carried forward.

New Companies.

A. D. A., Limited, 65a, Oxford Street, London, W.—Capital £3,500. Engineers, etc. Directors: S. R. Sheppard and F. R. Baker

Robert Knowles & Sons, Limited, 2, Caton Road, Lancaster.—Capital £500. Metal merchants, etc. Directors: Robert Knowles, J. Knowles and Reginald Knowles.

Stewardson & Son, Limited.—Capital £1,000. Engineers, etc. Provisional directors: J. C. Stewardson, 12, Durham Road, Sheffield; D. M. Stewardson and Mrs. M. Stewardson.

Darlington Rustless Steel & Iron Company, Limited.—Capital £100,000 in £1 shares. Solicitors: Clifford, Turner, Hopton & Lawrence, 81-87, Gresham Street, London, E.C.2.

South Eastern Engineering Company, Limited.—Capital £7,500 in £1 shares (500 "A" ordinary and 7,000 "B" ordinary). Directors: R. G. Chittenden, Bank Buildings, Maidstone; J. G. D. Oswald and W. G. Wallace.

Personal.

Mr. D. Sillars, general manager of the South Bank works of Messrs. Dorman, Long & Company, Limited, has just returned from an extensive tour of the Continent, during which he visited many iron and steel works.

The East of Scotland branches of the Associated Blacksmiths and Smithy Workers have presented Mr. James Jarvie, of Motherwell, with several gifts in appreciation of his services as organiser for the past 12 years.

Mr. Joseph Hepworth, managing director of Messrs. Hepworth & Grandage, Limited, engineers and ironfounders, Bradford, has been adopted as the prospective Conservative candidate for East Bradford parliamentary division at the next election.

Mr. H. Hurst, who for six years was foundry manager to Messrs. Thos. White & Sons, Limited, Laughpark Engineering Works, Paisley, has been presented with a gold wristlet watch by the staff and workmen as a mark of esteem in which he was held by them, on the occasion of his leaving to become manager of the foundry department of Messrs. James Howden & Company, Limited, Glasgow.

Mr. Arthur Brampton (chairman), Mr. F. W. Fell Clark and Mr. Norman Hill have resigned from the board of the Coventry Chain Company, Limited. Mr. Charles W. Goff has been appointed chairman of the company, and has been elected a director of Messrs. Hans Renold, Limited. Mr. Charles G. Renold, chairman of Hans Renold, Limited, has been elected to the board of the Coventry Chain Company, Limited.

Mr. Clarence A. Seyler, of Swansea, has been chosen as President-elect of the South Wales Institute of Engineers for 1931, and he will be installed in office in January. Mr. Seyler is a well-known analytical chemist. He has contributed two valuable Papers to the "Transactions" of the Institute.

Mr. Victor Watlington has resigned his appointment as managing director of the English Electric Company, Limited. He retains his seat on the board. Mr. George H. Nelson, who has joined the board, has been appointed managing director of the company, and will take up his appointment this month.

Wills.

Tyzack, J., of Sheffield and Totley, steel manufacturer £15,885

Bates, A. J., managing director of Messrs. Joseph & Edward Bates & Sons, Limited, of Temple Street, Wolverhampton, brass founders ... £29,296

Wood, Sir Edward Graham, founder, chairman and managing director of Messrs. Edward Wood & Company, Limited, Ocean Ironworks, Manchester, and governing director of the Trafford Park Steel Warehouse, Limited, Trafford Park, Manchester £132,672

Obituary.

Mr. Arthur Scholefield, of Alnmouth, Northumberland, chairman of Messrs. A. Reyrolle & Company, Limited, electrical engineers, Hebburn-on-Tyne, and a director of Messrs. Smith's Dock Company, Limited, died on Sunday, September 28, aged 77.

Contracts Open.

Cheltenham, October 31.—Pumping machinery, for the Corporation. Mr. J. S. Pickering, water engineer, Municipal Offices, Cheltenham.

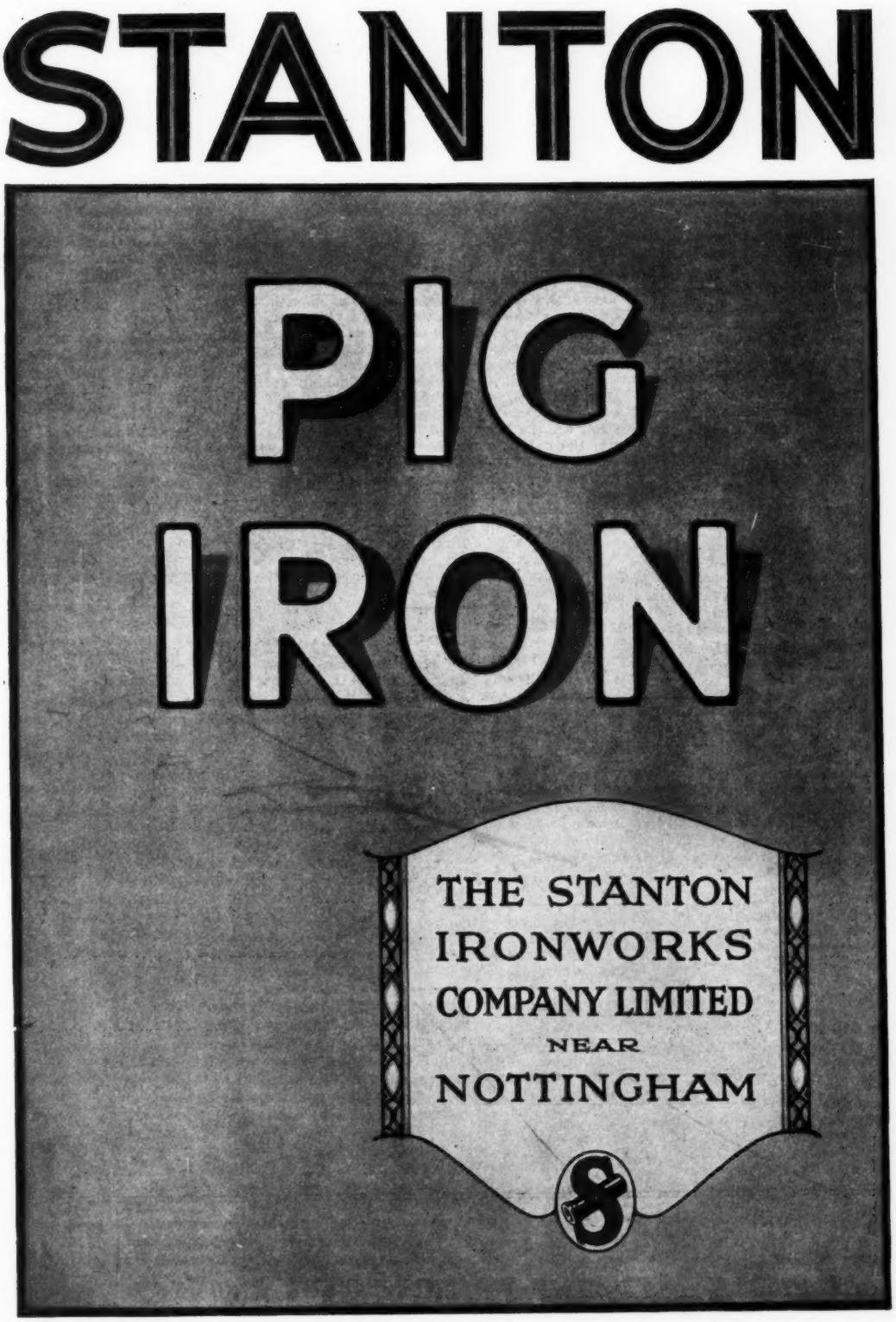
Haywards Heath, October 21.—160 tons of cast-iron socket and spigot pipes, for the Cuckfield Rural District Council. Mr. F. Martin, engineer, Boltro Road, Haywards Heath. (Fee £2 2s., returnable.)

Leasingham, Sleaford, October 11.—Pump, for the Sleaford Rural District Council. Mr. E. H. Sills, engineer, Council Offices, Northgate, Sleaford.

London, E.C., October 24.—175-ton and 30-ton overhead travelling cranes, for the County of London Electric Supply Company, Limited, County House, 46-47, New Broad Street, E.C.2. (Fee £5 5s., returnable.)

Turkey, October 13.—Copper, brass, lead and zinc sheets, etc., for the Direction-General of State Railways and Ports, Ankara. The Department of Overseas Trade. (Reference A.X. 10,261.)

XUM


STANTON
PIG
IRON
THE STANTON
IRONWORKS
COMPANY LIMITED
NEAR
NOTTINGHAM

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—With the turn of the third quarter, somewhat confident hopes were entertained in Cleveland iron-trade circles that the depression so long overhanging the industry might have been lightened to some extent by an early renewal of more active buying on the part of home consumers, but this optimistic view of the position, it is to be feared, is not borne out by the actual results of the past week's business. Markets, as a matter of fact, are but sparsely attended nowadays, buyers are apathetic and, despite reduced prices, producers in this country are being undersold both at home and abroad. Briefly reviewing the governing factors in the present position, the financial crises in various foreign countries and in British Dominions have undoubtedly helped to restrict business, but the chief centre of disturbance has been the Continental Steel Cartel, whose dissolution has thrown iron and steel markets into chaos. Another adverse factor is the general depression in the heavy trades of this country. Far less raw material is being used by founders and engineers, and when orders are placed they are chiefly for small parcels for early delivery. A few forward contracts have been placed, but the tonnage involved is not heavy, and most of the business passing consists of small parcels for October delivery. In the conditions thus outlined prices are stationary at the official rates, as follow:—No. 1 Cleveland foundry iron, 66s. per ton; No. 3 G.M.B., 63s. 6d.; No. 4 foundry, 62s. 6d.; No. 4 forge, 62s. per ton.

The market for East Coast hematite continues the improvement recently reported, owing, doubtless, to a gradual reduction of stocks. In addition, consumers are taking better deliveries against contracts, while, as the statistical position improves, sellers find themselves able to stand more firmly for 71s. as the figure for East Coast mixed numbers and 71s. 6d. for No. 1 quality. On the North-West Coast, Bessemer mixed numbers are again quoted at 70s. per ton at works.

LANCASHIRE.—The position of markets for foundry pig in this area continues much the same as last reported, with only a quiet demand, mostly for early delivery. In this section of the market, perhaps, it is the unsatisfactory conditions at the consuming end of the trade rather than the price factor which are handicapping forward buying. As concerns prices, these are unchanged, with Derbyshire and Staffordshire No. 3 marked at 72s. and Scotch brands at 92s. 6d. per ton, delivered equal Manchester.

THE MIDLANDS.—Foundries in the Black Country districts are, with few exceptions, experiencing a rather slack time at present, with corresponding effect upon pig-iron markets, in which, of late, buying has been on a restricted scale. At the recent meeting of Midland producers no change was made in current quotations, which therefore remain as follow:—Northants No. 3, 70s.; Derbyshire No. 3, 73s. 6d.; and North Staffordshire No. 3, 73s. 6d. Scottish makes are quoted at 93s. to 97s., all per ton, delivered local stations.

SCOTLAND.—Requirements of foundries for pig-iron in this area are still on a limited scale, with prices unchanged, Scotch foundry quality being quoted at 76s. 6d. per ton, delivered consumers' works.

Finished Iron.

Work in the bar mills in the South Staffordshire area is still far from satisfactory, and the demand for crown and the cheaper grades of iron is poor. None of the makers is in a position to secure sufficient business to keep up regular working. The position is more satisfactory with regard to Staffordshire marked bars. The makers of this grade of iron continue to receive quite good support at the price of £12 10s. at works. Crown bars are offered at between £10 and £10 5s., and the nut and bolt grade at about £9 delivered this area. The makers of the latter grade of iron have to bear the brunt of foreign competition, which is still intense, Continental prices being £5 7s. 6d. to £5 10s., in comparison with £9 from the local works.

Steel.

Generally, the markets for steel and semi-products remain dull and uneventful, and at Sheffield this week sales of acid billets were small, with basic qualities also in poor demand. All prices are, however, maintained at the old figures. Production of open-hearth steel continues to decline, more furnaces having gone out of operation within the last few weeks. The British railways are taking considerably less steel, but somewhat improved orders from overseas railways are coming to hand. Special steels are the bright spot in the local steel industry, and the output of rustless steel is on an important scale. In the finished-steel department competition has been keen for any orders passing, but the volume of business transacted has been disappointing. There has been a considerable amount of inquiry, but only a comparatively small proportion of this has materialised into business. The tinplate market remains quietly steady, with the ruling quotation still on the 17s. basis for coke quality, net cash, f.o.b. Welsh ports.

Scrap.

Markets for foundry scrap material disclose only a limited demand, and on Tees-side dealings this week have been on a curtailed scale, and then only at extremely low prices. Where quotations are changed at all, the movements are in a downward direction. Thus, ordinary quality of heavy cast iron is now obtainable at 52s. 6d. per ton, and in the absence of any buyers of machinery quality a nominal sellers' price is 55s. In Yorkshire, however, a few lots of machinery cast iron are being disposed of, with 57s. 6d. as the top price, but ordinary quality is neglected at 55s. delivered. In Scotland the position in the iron and steel scrap market at the moment is very difficult, the works having practically suspended deliveries of all classes of scrap, as at present they are overstocked. For heavy machinery quality 61s. 3d. is nominally quoted, with ordinary cast iron at 55s. to 57s. 6d. and light metal at 45s., all per ton, delivered consumers' works.

Metals.

Copper.—After reaching last week a low record point in values, warrant copper rallied slightly towards the close and recovered partially, although still giving signs of weakness. In spite, however, of the reduction in values, the response by consumers has so far been very half-hearted, especially in this country and France. Germany has bought a moderate tonnage, and in the United States demand is said to have improved slightly, although the prevailing sentiment, as illustrated by movements on Wall Street, is distinctly "bearish."

Closing quotations :—

Cash.—Thursday, £44 12s. 6d. to £44 15s.; Friday, £43 18s. 9d. to £44 1s. 3d.; Monday, £44 11s. 3d. to £44 12s. 6d.; Tuesday, £43 17s. 6d. to £44; Wednesday, £43 11s. 3d. to £43 12s. 6d.

Three Months. — Thursday, £44 10s. to £44 12s. 6d.; Friday, £43 17s. 6d. to £43 18s. 9d.; Monday, £44 11s. 3d. to £44 12s. 6d.; Tuesday, £43 17s. 6d. to £44; Wednesday, £43 11s. 3d. to £43 12s. 6d.

Tin.—The issue of the September statistics has evidently had an adverse effect upon the market for standard tin, which has again declined during the past week. Although the visible supplies showed a decrease of 3,300 tons, something like a thousand tons more than was expected, shipments during this month are estimated at 8,000 tons. As might be expected, consumers have held off, and until the slump is checked they are not likely to come into the market. The outlook is again very uncertain, and confidence has been badly shaken.

Official closing prices :—

Cash.—Thursday, £124 to £124 5s.; Friday, £123 15s. to £123 17s. 6d.; Monday, £124 12s. 6d. to £124 17s. 6d.; Tuesday, £122 to £122 5s.; Wednesday, £119 5s. to £119 10s.

Three Months.—Thursday, £125 12s. 6d. to £125 15s.; Friday, £125 5s. to £125 7s. 6d.; Monday, £126 to £126 5s.; Tuesday, £123 10s. to £123 15s.; Wednesday, £120 15s. to £121.

Spelter.—In spite of rather more buying by galvanisers, the fall in values has continued with hardly a check, until the price stands little above the lowest figure ever recorded for this metal. The market has naturally been influenced by the all-round weakness in other non-ferrous metals.

Daily fluctuations :—

Ordinary.—Thursday, £14 12s. 6d.; Friday, £14 13s. 9d.; Monday, £14 13s. 9d.; Tuesday, £14 10s.; Wednesday, £14 1s. 3d.

Lead.—In the market for soft foreign pig the tendency has been downward, with somewhat erratic price movements, and it seems fairly evident that the big interests which have hitherto supported the market are now losing their grip. Demand, particularly from Germany, has been distinctly poor, and it looks very much as if European stocks must increase.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £16 8s. 9d.; Friday, £16 11s. 3d.; Monday, £16 6s. 3d.; Tuesday, £16 2s. 6d.; Wednesday, £15 15s.

The Continental Steel Cartel.

As already reported, the Continental Steel Cartel has been provisionally prolonged until the end of the year and the production of the members reduced by 25 per cent. as compared with the actual output last October. It is now stated that at the recent Liége meeting it was proposed to re-introduce the penalty of $4 per ton for excess output, and that it was left to the national groups by a specified date to intimate their acceptance or refusal of this proposal. The German group is said to have agreed, but the attitude of the other national groups has so far not been ascertained. Naturally, without the application of the penalty there would be no assurance of the maintenance of the 25 per cent. restriction in production.

The pool for semi-products for Great Britain, as already announced, was dissolved on September 12.

CAST IRON FLANGED PIPES
2 in.–12 in. & CONNECTIONS. to 24 in. dia.
WE HAVE FIFTY YEARS OF ACCUMULATED EXPERIENCE AND METAL PATTERNS.
JAMES & RONALD RITCHIE, LTD.,
Telephone: 52 & 53. MIDDLESBROUGH. Telegrams: "Ritchie, Middlesbrough."

Special CARBON BLACKING

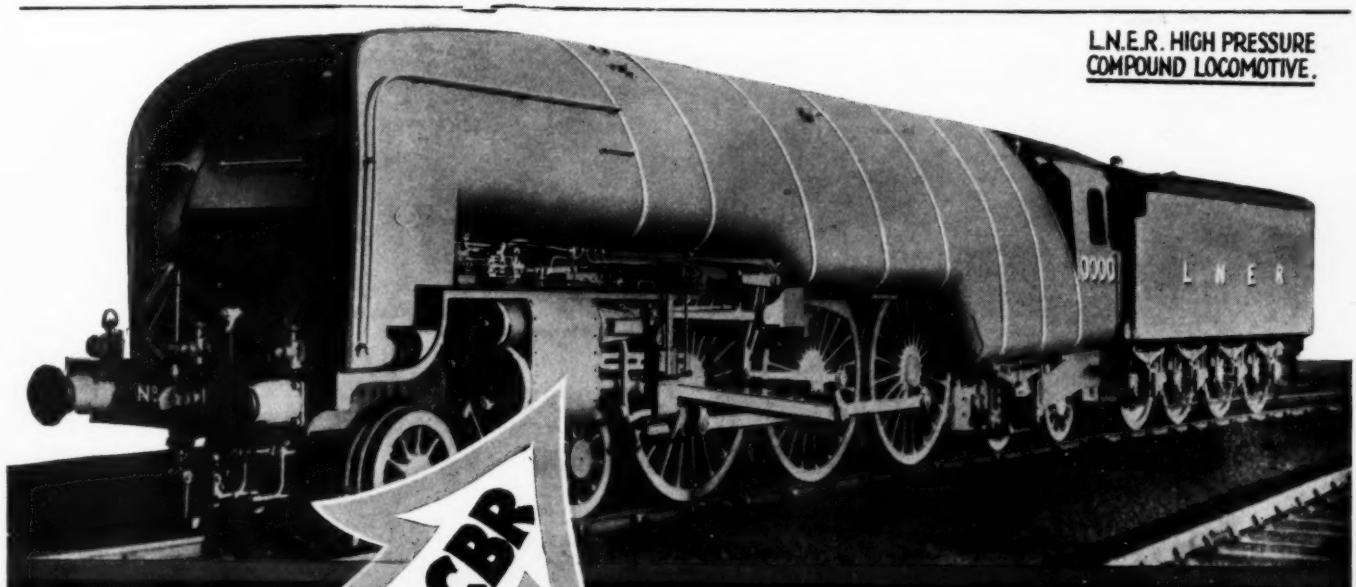
PLUMBAGO
CORE GUM
WHITE DUST
COAL DUST
REQUISITES

67 MADE BY A FIRM WITH YEARS EXPERIENCE.

JAS. DURRANS & SONS. LIMITED.
PHŒNIX WORKS PENISTONE. NR. SHEFFIELD.

Also—
GANISTER,
LOAM AND SAND MILLS,
STUDS,
CHAPLETS,
BRUSHES,
CORE ROPES,
BUCKETS,
SPADES, Etc.
LADLES,
FIRE BRICKS,
STONE FLUX,
CASTING CLEANERS,
PIPE NAILS,
SPRIGS,
WIRE BRUSHES,
BELLOWS,

L.N.E.R. HIGH PRESSURE COMPOUND LOCOMOTIVE.



WARNER CBR

WARNER CBR
CYLINDER PIG IRON.
SPECIFIED BY THE L.N.E.R. FOR THE CAST IRON LOW PRESSURE CYLINDERS OF THE ABOVE LOCOMOTIVE. THEIR COMPLETE CONFIDENCE IS THE RESULT OF LONG EXPERIENCE WITH WARNER CBR IN ALL THEIR LOCOMOTIVE CYLINDERS.

WARNER & CO. LTD., CARGO FLEET MIDDLESBROUGH ON TEES.
TELEPHONE — MIDDLESBROUGH 4265 TELEGRAMS — REFINERY, MIDDLESBROUGH

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	43	11	3
Three months	43	11	3
Electrolytic	46	10	0
Tough	45	10	0
Best selected	46	0	0
Sheets	75	0	0
India	58	0	0
Wire bars	47	10	0
Do. October	47	10	0
Do. November	47	10	0
Ingot bars	47	10	0
H.C. wire rods	49	5	0
Off. av. cash, September	46	6	$0\frac{27}{64}$
Do., 3 mths. September	46	6	$8\frac{25}{64}$
Do., Sttlmnt., September	46	6	$0\frac{9}{11}$
Do., Electro, September	50	1	$7\frac{1}{11}$
Do., B.S., September	49	7	6
Do., wire bars, September	50	13	$7\frac{7}{11}$
Solid drawn tubes			11½d.
Brazed tubes			11½d.
Wire			7½d.

BRASS.

Solid drawn tubes	10½d.
Brazed tubes	12½d.
Rods, drawn	10d.
Rods, extd. or rlld.	6½d.
Sheets to 10 w.g.	8½d.
Wire	8½d.
Rolled metal	8½d.
Yellow metal rods	6d.
Do. 4 × 4 Squares	6½d.
Do. 4 × 3 Sheets	7½d.

TIN.

	£	s.	d.
Standard cash	119	5	0
Three months	120	15	0
English	120	5	0
Bars	122	10	0
Straits	122	10	0
Australian	121	0	0
Eastern	126	2	6
Banca	123	10	0
Off. av. cash, September	132	14	$0\frac{2}{32}$
Do., 3 mths., September	134	6	$11\frac{31}{32}$
Do., Sttlmt., September	132	14	$1\frac{1}{11}$

SPELTER.

	£	s.	d.
Ordinary	14	1	3
Remelted	13	5	0
Hard	11	0	0
Electro 99.9	16	15	0
English	14	17	6
India	13	0	0
Zinc dust	21	0	0
Zinc ashes	3	15	0
Off. aver., September	15	18	$5\frac{13}{32}$
Aver., spot, September	15	15	$5\frac{8}{11}$

LEAD.

	£	s.	d.
Soft foreign ppt.	15	15	0
English	17	5	0
Off. average, September	17	17	$0\frac{13}{32}$
Average spot, September	17	18	$2\frac{3}{11}$

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	24	0	0
Do. V.M. ex-whf.	24	15	0
Rods	28	0	0
Boiler plates	20	0	0
Battery plates	21	0	0

ANTIMONY.

	£	s.	d.
Special brand, Eng.	38	0	0
Chinese	26	5	0
Crude	22	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£7 17 6
45/50%	£11 10 0
75%	£18 10 0
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free	4/2 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	11½d. lb.
Ferro-phosphorus, 20/25%	£16 0 0
Ferro-tungsten—	
80/85%	2/3 lb.
Tungsten metal powder—	
98/99%	2/6 lb.
Ferro-chrome—	
2/4% car.	£30 10 0
4/6% car.	£23 5 0
6/8% car.	£22 7 6
8/10% car.	£22 0 0
Ferro-chrome—	
Max. 2% car.	£32 17 6
Max. 1% car.	£37 15 0
Max. 0.70% car.	£42 7 6
70% carbon-free	11d. lb.
Nickel—99% cubes, or pellets	£175 0 0
Ferro-cobalt	9/7 lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	2/7 lb.
Ferro-manganese (net)—	
76/80% loose	£11 0 0 to £11 15 0
76/80% packed	£12 0 0 to £12 15 0
76/80% export	£10 10 0 to £11 0 0
Metallic manganese—	
94/96% carbonless	1/4 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 2
Finished bars, 18% tungsten	£0 3 0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to $\frac{1}{16}$ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	2	12	6	to	2	15	0
Bundled steel and shrngs.	2	7	6	to	2	11	6
Mixed iron and steel	2	5	0	to	2	11	6
Heavy cast iron					2	12	6
Good machinery for foundries					2	17	6
Cleveland—							
Heavy steel					2	7	6
Steel turnings					1	17	6
Cast-iron borings					1	12	6
Heavy forge					3	5	0
W.I. piling scrap					2	17	6
Cast-iron scrap	2	12	6	to	2	15	0
Midlands—							
Ord. cast-iron scrap	2	7	6	to	2	10	0
Heavy wrought	2	12	6	to	2	15	0
Steel turnings					1	7	6
Scotland—							
Heavy steel					2	10	0
Ordinary cast iron					2	15	0
Engineers' turnings					1	17	6
Cast-iron borings					1	15	0
Wrought-iron piling					3	7	6
Heavy machinery					3	1	6

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	38	0	0
Brass	28	0	0
Lead (less usual draft)	14	10	0
Tea lead	11	0	0
Zinc	8	10	0
New aluminium cuttings	54	0	0
Braziery copper	35	0	0
Gunmetal	40	0	0
Hollow pewter	97	0	0
Shaped black pewter	72	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	66/-
Foundry No. 3	63/6
Foundry No. 4	62/6
Forge No. 4	62/-
Hematite No. 1	71/6
Hematite M/Nos.	71/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	79/6
„ d/d Birm.	88/6
Midlands—	
Staffs. common*	—
„ No. 4 forge*	68/6
„ No. 3 fdry.*	73/6
Shrops. basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	65/-
„ fdry. No. 3*	70/-
Derbyshire forge*	68/6
„ fdry. No. 3*	73/6
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	79/-
„ No. 3	76/6
Hem. M/Nos.	77/-
Sheffield (d/d district)—	
Derby forge	63/6
„ fdry. No. 3	68/6
Lincs. forge	—
„ fdry. No. 3	70/-
E.C. hematite	83/6
W.C. hematite	86/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	67/-
„ fdry. No. 3	72/-
Staffs foundry No. 3	72/-
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	92/6
Glengarnock, No. 3	—
Eglinton, No. 3	92/6
Gartsherrie, No. 3	92/6
Monkland, No. 3	92/6
Shotts, No. 3	92/6

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	10	0	0	to	10	15	0
Nut and bolt iron					9	0	0
Hoops	10	15	0	to	12	0	0
Marked bars (Staffs) f.o.t.					12	10	0
Gas strip	10	15	0	to	12	0	0
Bolts and nuts, ½ in. × 4 in.					15	5	0
Steel—							
Ship plates	8	15	0	to	8	17	6
Boiler plts.	9	10	0	to	10	10	0
Chequer plts.					10	12	6
Angles					8	7	6
Tees					9	7	6
Joists					8	10	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ⅜ in. (Untested)					7	15	0

and upwards

Flats—8 in. wide and over	£8 12 6
„ under 8 in. and over 5in.	8 17 6
Rails, heavy	8 10 0
Fishplates	12 0 0
Hoops (Staffs)	£9 5 0 to 9 15 0
Black sheets, 24g.	9 12 6 to 9 15 0
Galv.cor.shts., 24g.	11 12 6
Galv. fencing wire, 8g. plain	12 0 0
Billets, soft	5 15 0 to 6 5 0
Billets, hard	7 10 0 to 8 0 0
Sheet bars	5 15 0
Tin bars	5 15 0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/-
Sheet to 10 w.g.	1/0½
Wire	1/1½
Rods	1/0½
Tubes	1/5½
Castings	1/1

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	8d. to 1/2
Rolled—	
To 9 in. wide	1/2 to 1/8
To 12 in. wide	1/2½ to 1/8½
To 15 in. wide	1/2½ to 1/8½
To 18 in. wide	1/3 to 1/9
To 21 in. wide	1/3½ to 1/9½
To 25 in. wide	1/4 to 1/10
Ingots for spoons and forks	8d. to 1/4½
Ingots rolled to spoon size	11d. to 1/7½
Wire round—	
3/0 to 10 G.	1/5½ to 2/0½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	19.26
No. 2 foundry, Valley	17.50
No. 2 foundry, Birm.	14.00
Basic	18.76
Bessemer	19.76
Malleable	19.76
Grey forge	18.76
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	31.00
Billets	31.00
Sheet bars	31.00
Wire rods	36.00
	Cents.
Ironbars, Phila.	2.09
Steel bars	1.65
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.70
Skelp, sheared steel	1.70
Steel hoops	1.95
Sheets, black No. 24	2.45
Sheets, galv., No. 24	3.00
Sheets, blue an'l'd, No. 13	2.05
Wire nails	2.09
Plain wire	2.30
Barbed wire, galv.	2.70
Tinplates, 100-lb. box	$5.00

COKE (at ovens).

Welsh foundry	26/- to 27/6
„ furnace	17/6 to 21/6
Durham and Northumberland—	
„ foundry	14/6 to 15/-
„ furnace	14/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box		17/-
„	28×20 „		34/-
„	20×10 „		24/6
„	18¾×14 „		17/9
C.W.	20×14 „		15/6
„	28×20 „		32/-
„	20×10 „		23/6
„	18¾×14 „		17/-
Terneplates	28×20		31/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	17	6	to	£16	15	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods dead soft, steel	£11	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ½ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
Oct.	2 ..	44	12	6	inc.	15/-
,,	3 ..	43	18	9	dec.	13/9
,,	6 ..	44	11	3	inc.	12/6
,,	7 ..	43	17	6	dec.	13/9
,,	8 ..	43	11	3	,,	6/3

Electrolytic Copper.

		£	s.	d.		
Oct.	2 ..	46	10	0	No change	
,,	3 ..	46	10	0	,,	,,
,,	6 ..	46	10	0	,,	,,
,,	7 ..	46	10	0	,,	,,
,,	8 ..	46	10	0	,,	,,

Standard Tin (cash).

		£	s.	d.		
Oct.	2 ..	124	0	0	dec.	20/-
,,	3 ..	123	15	0	,,	5/-
,,	6 ..	124	12	6	inc.	17/6
,,	7 ..	122	0	0	dec.	52/6
,,	8 ..	119	5	0	,,	55/-

Tin (English ingots).

		£	s.	d.		
Oct.	2 ..	125	0	0	dec.	30/-
,,	3 ..	124	15	0	,,	5/-
,,	6 ..	125	15	0	inc.	20/-
,,	7 ..	123	0	0	dec.	55/-
,,	8 ..	120	5	0	,,	55/-

Zinc Sheets (English).

		£	s.	d.		
Oct.	2 ..	26	0	0	No	change
,,	3 ..	24	0	0	dec.	40/-
,,	6 ..	24	0	0	No	change
,,	7 ..	24	0	0	,,	,,
,,	8 ..	24	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
Oct.	2 ..	14	12	6	inc.	2/6
,,	3 ..	14	13	9	,,	1/3
,,	6 ..	14	13	9	No	change
,,	7 ..	14	10	0	dec.	3/9
,,	8 ..	14	1	3	,,	8/9

Lead (English).

		£	s.	d.		
Oct.	2 ..	18	0	0	No	change
,,	3 ..	18	0	0	,,	,,
,,	6 ..	17	15	0	dec.	5/-
,,	7 ..	17	10	0	,,	5/-
,,	8 ..	17	5	0	,,	5/-

AVERAGE MONTHLY PRICES OF STEEL SHIP ANGLES (NORTH OF ENGLAND).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	4 15 0	4 17 6	5 0 0	5 0 0	5 0 0	4 17 6	4 17 6	4 17 6	4 17 6	5 0 0	5 7 6	5 7 6	4 19 9½
1897	5 7 6	5 7 6	5 7 6	5 5 0	5 0 0	5 0 0	5 2 6	5 2 6	5 2 6	5 0 0	5 5 0	5 3 5½	
1898	5 5 0	5 5 0	5 5 0	5 7 6	5 13 9	5 15 0	5 15 0	5 15 0	5 17 6	6 0 0	6 5 0	6 7 6	5 14 3
1899	6 10 0	6 12 6	6 15 0	6 15 0	6 17 6	6 17 6	7 0 0	7 5 0	7 5 0	7 12 6	7 15 0	7 0 5	
1900	7 15 0	8 0 0	8 2 6	8 5 0	8 5 0	8 7 6	8 7 6	8 2 6	8 2 6	8 0 0	7 10 0	7 10 0	8 0 7½
1901	6 15 0	6 12 6	6 5 0	6 0 0	6 0 0	5 10 0	5 15 0	5 17 6	6 0 0	5 17 6	5 17 6	5 15 0	6 0 5
1902	5 12 6	5 10 0	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 7 6	5 11 8
1903	5 6 3	5 6 3	5 7 6	5 12 6	5 12 6	5 12 6	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 8 9	
1904	5 0 0	4 17 6	5 2 6	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 0 0	5 0 0	5 0 0	5 2 6	
1905	5 5 0	5 7 6	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 12 6	6 2 6	6 12 6	5 14 4½	
1906	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 13 4	
1907	6 17 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	6 12 6	7 0 5	
1908	6 2 6	6 2 6	6 2 6	5 17 6	5 17 6	5 17 6	5 17 6	5 12 6	5 12 6	5 12 6	5 12 6	5 16 3	
1909	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 7 6	5 7 6	5 7 6	5 7 6	5 7 6	5 7 6	5 9 7	
1910	5 16 3	5 17 6	5 17 6	6 1 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 7 6	6 7 6	6 2 3½	
1911	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 9 0	6 7 8½	
1912	6 16 3	6 17 6	6 17 6	7 5 0	7 7 6	7 7 6	7 7 6	7 12 6	7 12 6	7 12 6	7 14 6	7 17 6	7 7 4½
1913	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 11 6	7 7 6	6 15 6	6 7 6	6 2 6	7 8 11½
1914	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	5 15 0	5 15 0	6 15 0	7 0 0	7 0 0	7 1 3	7 5 0	6 8 7½
1915	7 17 0	8 5 0	8 17 6	9 5 0	9 5 0	9 15 0	9 15 0	9 15 0	9 15 0	9 15 0	10 15 0	10 15 0	9 8 3½
1916	11 3 1½	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6
1917	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6
1918	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6
1919	11 2 6	13 12 6	13 12 6	13 12 6	17 2 6	17 1 3	17 0 0	17 15 0	17 15 0	17 15 0	17 17 6	18 5 0	16 1 9
1920	19 10 0	20 0 0	21 10 0	22 0 0	23 5 0	24 0 0	24 0 0	24 0 0	24 15 0	24 10 0	24 0 0	24 0 0	22 19 2
1921	22 10 0	20 12 6	19 0 0	17 10 0	17 10 0	16 6 0	14 10 0	14 3 4	13 10 0	11 15 0	10 0 0	9 12 6	15 11 7
1922	9 17 6	10 0 0	10 0 0	10 0 0	10 0 0	9 17 6	9 10 0	8 15 7½	8 14 0	8 12 6	8 12 6	8 12 6	9 7 8½
1923	8 18 1½	9 1 3	9 14 0	10 0 0	10 0 0	10 0 0	9 8 9	9 9 6	9 10 0	9 8 9	9 11 6	9 18 9	9 11 8½
1924	10 0 0	9 18 1½	9 17 6	9 17 6	9 17 2	9 11 3	9 15 0	9 15 0	9 9 4½	9 6 6	9 5 0	9 5 0	9 13 1½
1925	9 2 0	9 0 11½	9 0 0	8 15 9	8 10 3½	8 6 3	8 2 6	7 19 0½	7 12 3	7 5 0	7 2 6	8 5 5½	
1926	7 2 6	7 2 6	7 2 6	7 3 4	7 2 9	7 7 6	7 8 5½	7 9 0	7 12 6	7 16 3	8 0 6	7 7 7½	
1927	7 18 9	7 17 6	7 17 6	7 14 8½	7 13 9	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 12 6	7 14 1½	
1928	7 12 6	7 14 9	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 16 10½	
1929	7 17 6	7 17 6	7 17 6	7 17 6	8 0 6	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 5 0	8 1 1	
1930	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	—	—	—	—

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